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Shading

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03 2007

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1 About shading and texturing surfaces

About

Surface shading



Image by Danny Mousses

In the real world, what an object is made of is one of two main factors that determine the appearance of its surface (the other is light). This is because when light hits the objects, some of the light is absorbed and some of it is reflected. The smoother the object, the shinier it is; the rougher the object, the more matte it is.

In Autodesk® Maya® , the appearance of a surface is defined by how it's *shaded*. Surface shading is a combination of the basic material of an object and any textures that are applied to it.

In Maya, *materials* (also called *shaders*) define an object's substance. Some of the most basic attributes of materials include color, transparency, and shine. For more information on materials in Maya, see "Surface, displacement, volumetric materials" on page 27.

Factors beyond basic color, transparency, and shine that determine the appearance of an object's surface (such as more complex color, transparency, shine, surface relief, reflection, or atmosphere) are defined by textures. For more information on textures, see "2D and 3D textures" on page 29, "Procedural textures" on page 30, and "File textures" on page 31.

Surface texture

In visual arts, a texture is any kind of surface detail, both visual and tactile. In Maya, you create surface detail with textures connected to the material of objects as texture maps. (Materials define a the basic substance of an object; see "Surface shading" on page 19 for more details.)

For more information on texture maps, see "Texture mapping" on page 34.

Factors beyond basic color, transparency, and shine (see below) that determine the appearance of an object's surface include:

- Surface relief. See "About surface relief" on page 111 for more information.
- Whether or not the surface casts or catches reflections. See "True reflections" on page 135 for more information. (Objects typically reflect backgrounds or environments; see "About backgrounds" on page 123 for more information.)
- Atmosphere. See "Fog, smoke, dust, and silt" on page 141 for more information.

You can also bake illumination and color to a texture that you can later apply to objects in a scene. See "Baking illumination and color" on page 147.

Color

You can work with color in Maya in so many different ways. Here are some of the most common:

- Change the basic color of an object by adjusting the color attribute of a material applied to the object. To find out more about material node attributes, see "Render node attributes" on page 25.
- Apply a texture as a color map to the material's color attribute.
  - For more information about texture mapping, see "Texture mapping" on page 34.
  - To map a 2D or 3D texture, see "Map a 2D or 3D texture" on page 74.
- Use a Ramp Shader for extra control over the way color changes with light and view angle. You can simulate a variety of exotic materials and tweak traditional shading in subtle ways. For a description of the Ramp Shader, see "Ramp Shader" on page 325.
- Expand, enhance, or manipulate colors in applied textures using the Color utilities. For example, you can blend colors, adjust contrast, and convert HSV to RGB. For a description of each of the color utilities and what you can use them for, see "About Color Utilities" on page 499.

Transparency

You can work with the transparency of an object in the following ways:

- Change the transparency level of an object adjusting the transparency attribute of a material applied to the object. To find out more about material node attributes, see "Render node attributes" on page 25.
- Apply a texture as a transparency map to the material's transparency attribute to designate which areas of an object are opaque, transparent or semi-transparent.
  - For more information about texture mapping, see "Texture mapping" on page 34.
  - To map a 2D or 3D texture, see "Texture mapping" on page 34.

Specular highlight (shine)

You can work with the shininess of objects in your scene in the following ways:

- Change the intensity and size of the specular highlights of an object by adjusting the Specular Shading attributes of a material applied to the object. To find out more about material node attributes, see "Render node attributes" on page 25 and "Common surface material Specular Shading attributes" on page 316.
- Apply a texture as a specularity map to the material's Specular Color attribute to designate which areas of an object shine (and the color of the highlights).
  - For more information about texture mapping, see "Texture mapping" on page 34.
  - To map a 2D or 3D texture, see "Texture mapping" on page 34.

Note Only materials with specular attributes (Anisotropic, Blinn, Phong, and PhongE) have surface highlights. The *specular highlight* is the white shiny glow on the material.



Anisotropic Blinn Phong PhongE

What are specular highlights?

Some surfaces are shinier than others (for example a wet fish has a shinier surface than a dry leaf). Depending on how shiny a surface is, it reflects light in different ways.

Shiny objects reflect light directly; matte objects diffuse light. Specular highlights show the places on the object where the light sources are reflected at consistent angles; reflections on an object show, among other things, light bounced from surrounding objects.

Specular highlights depend directly on the view (camera), not the position of the light, like diffuse shading does.

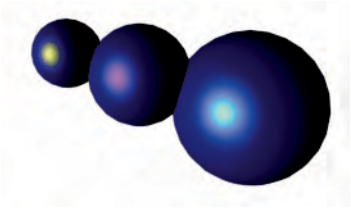
Tip	The Blinn material is recommended for shiny surfaces in animations. Highlights on other specular materials, like Phong and PhongE, may flicker when animated.

Highlights



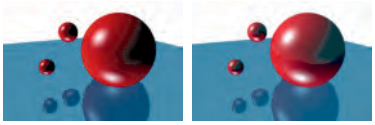
The size of a specular highlight on a surface makes the surface look either flat or shiny.

Highlight color



You can control the color of highlights on surfaces.

Reflections



You can control the degree of reflectivity as well as other surface properties like refracted color.

Swatch rendering for any renderer

You can see visual representations of all shading nodes in swatch form in Maya. For example, you can now view mental images® mental ray® for Maya® custom shaders, and custom hardware shaders in Hypershade, when the appropriate renderer (mental ray for Maya renderer, or Hardware renderer) is selected. For more information on swatch rendering for mental ray for Maya, see ”Swatch rendering in mental ray for Maya” on page 169 in the *Shading* guide.

Notes	To maintain maximum performance when IPR is running, swatches in Hypershade are not updated.

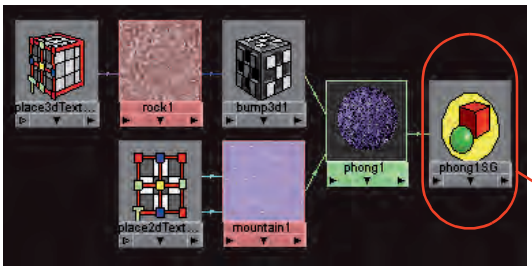
Shading networks

About shading networks

A *shading network* is a collection of connected rendering nodes that defines how colors and textures contribute (usually with lights) to the final look of surfaces (materials). A shading network typically consists of any number of connected rendering nodes plugged into a shading group node. (For more information about render nodes, see ”Render nodes” on page 24.)

A good portion of your time building shading networks is spent connecting node attributes to each other and adjusting node attributes to describe what a surface should look like and how it should be positioned.

To build shading networks, see ”Overview of building shading networks” on page 44.



The *shading network* is a collection of connected *nodes*.

Shading group node

Importing shading networks

By default, when you import a file more than once into Maya, the geometry and shading networks are duplicated. These redundant shading networks and reassignment of geometry inflate the scene size and load time, and clutter your working scene. You can prevent the duplication of a shading network (unless, of course, you need it) when you import a scene, or you can delete any duplicated network from within your working scene.

To prevent redundant shading networks on import, when you import a scene (File > Import > ❒), turn on Remove Duplicate Shading Networks.

To delete a redundant shading network, in Hypershade, select Edit > Delete Duplicate Shading Networks.

Shading group node

Shading networks are designed as a data flow network, where data streams from the left side of the network toward a final shaded result that emerges from the right node. The right most node (which is not always visible by default; click the Input and Output Connections button in the Hypershade to see it) is the Shading Group for that particular network.

The Shading Group is a collection of materials, textures, and lights that efficiently describe all the necessary attributes required to shade or render an image.

All of the nodes connected upstream (that is, farther to the left of the node) of the shading group contribute to the final look of surfaces in the scene. Adjusting any node's attributes or connections causes a downstream (that is, farther to the right) reaction that can be seen in the final rendered image. To learn more about these input and output connections, see "Show node connections" on page 56.

For a description of the Shading Group node's attributes, see "Shading group node attributes" on page 365.

Shader network libraries

Maya ships with a library of shader networks. To install the shader library, if it is not installed by default, see the *Installation and Licensing* guide. To view and work with shader network libraries, see "View the Shader Library Gallery" on page 68.

Maya also ships with a number of mental images® mental ray® shading networks (mental ray for Maya must be loaded to see them in the Hypershade). To create and load mental ray for Maya shading networks, see "Use a custom-made mental ray for Maya shader in Maya" on page 192.

Render nodes

Render nodes are the individual components you interconnect to use as building blocks to produce all rendering effects. Like all other nodes in Maya, you can animate or map render nodes to other nodes' parameters. For more information on Maya nodes, see "Nodes and attributes" in the *Basics* guide.

Texture nodes, placement nodes, and material nodes along with their input and output connections (attributes) define all aspects of the final rendered images, from surfaces to lights and shadows.

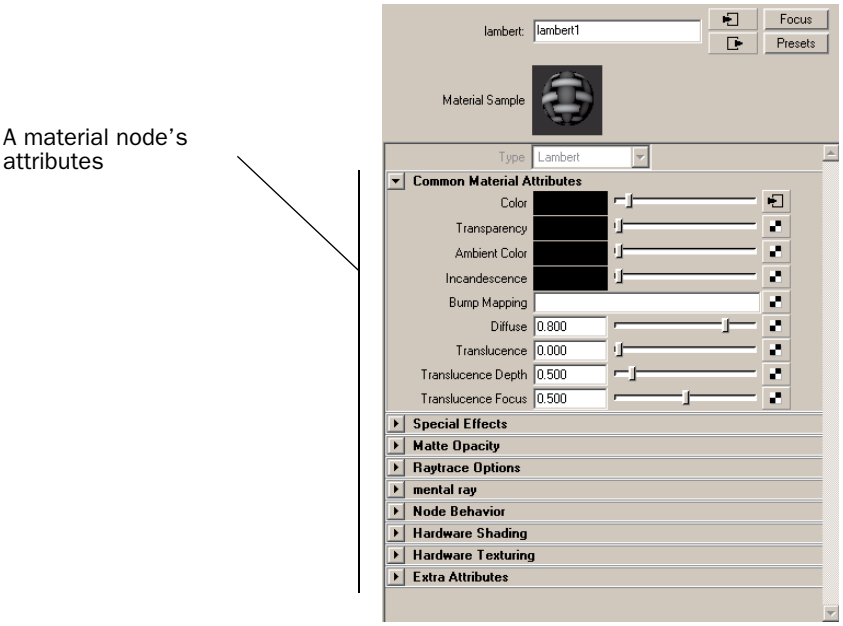
- To learn more about material nodes, see "Surface, displacement, volumetric materials" on page 27.
- To learn more about texture nodes, see "Overview of texture nodes" on page 367.
- To learn more about placement nodes, see "2D and 3D texture positioning" on page 38.

You can connect nodes to create the effects you want. You can also share nodes to create visual relationships, and to make rendering more efficient. For example, two objects can share a single texture so that both objects appear the same, but less memory and, or processing is required.

You can see and work with rendering nodes and shading networks in the Hypershade. To learn more about the Hypershade, see "Hypershade window" on page 278.

Render node attributes

A node attribute describes one aspect of the node. So, when you adjust an attribute of a node, you adjust one aspect of its description. For example, you can change the color attribute from red to blue. Or, you can change an opaque object to transparent by adjusting the transparency attribute.



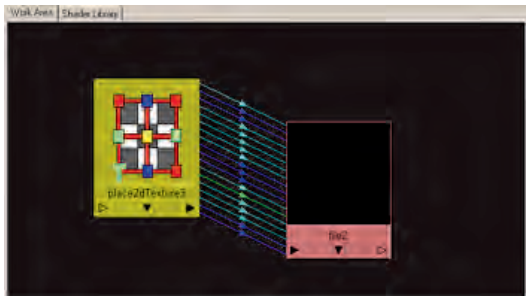
Although you can interactively adjust some attributes, typically you verify and enter precise numerical values using the Attribute Editor or display and adjust node attributes in the Attribute Spreadsheet or the Channel Box. (Only some attributes are displayed in the Channel Box. All attributes are displayed in Attribute Editor and Attribute Spreadsheet. To find out more about general editors such as the Attributes Editor and the Attribute spreadsheet, see "Attribute Editor" on page 338 in the *Basics* guide.)

To adjust render node attributes, see "Set node attributes" on page 65.

Render node connections

Connections between node attributes are shown by colored arrowed lines in the Hypershade. The connection lines between nodes indicate what type of data flows through the connection. Depending on the types of nodes and connections used, different information is passed. That is, values may be of color, distance, position, angle or object ID.

Note mental ray for Maya expects only certain connections to be made to the message attribute in the Attribute Editor. See "mental ray Shader connections" on page 155 for more details.



Some information can come as a single value (for example, OutAlpha is a single value) or as triple (for example, an RGB value or an XYZ value). Triple connections are represented by green connection lines. Single, double, triple, data, and array data each have an assigned default color.

You can customize the colors and their meanings. To change default connection line colors, see "Change default connection line colors" on page 53.

To connect render nodes, see "Connect render nodes using their default connections" on page 61.

Tip When you point to one of the lines that connects two nodes by their attributes, and information appears about the connection. To show and hide node connections, see "Show node connections" on page 56.

The Connection Editor

Each node has a default attribute and a list of commonly connected attributes that lets you make node connections interactively (dragging and dropping in Hypershade). The Connection Editor, however, is the best tool for fine-tuning a shading network and for making non-default connections.

Note	Some utility nodes can connect to a material's attributes only through "Connection Editor" on page 275.

The Connection Editor shows node network information in a side-by-side layout so that you can view two connected nodes in a node network. You can quickly and easily traverse from node to node and show a node's outputs or inputs. This helps to facilitate connections, meaning you can make connections in either direction in a node network.

For more information on the Connection Editor, see "Connection Editor" on page 275.

To connect nodes with the Connection Editor, see "Connect render nodes using the Connection Editor" on page 63.

Maya materials

Surface, displacement, volumetric materials

Though 3D surfaces in Maya respond to light similarly to those in the real world, there are important differences in the way that surfaces and lights interact in computer graphics software. Material nodes are a type of render node (see "Render nodes" on page 24) that, when applied to an object, let you define how the object's surface appears when rendered.

See also "Surface shading" on page 19.

In Maya, material nodes define how surfaces react to light. (The term shader is often used to describe the role played by a material node, especially in mental ray for Maya.) Maya contains several types of material nodes that help you simulate the real-world qualities or behaviors of surfaces to light: Surface material nodes, Displacement material nodes, and Volumetric material (atmosphere) nodes.

You can set a material's attributes, such as color, specularity, reflectivity, transparency, and surface detail of scene elements to create a wide variety of realistic images. For a detailed description of Maya's materials, their attributes, and guidelines on how to change them, see "Surface material", "Displacement material", and "Volumetric material (atmosphere)".

Note	When you first create an object, Maya's assigns a special version of the Lambert material (a surface material) by default.

Surface material

Surface materials represent the types of surfaces onto which you can map textures. Attributes such as shininess, matte, reflectivity, glossiness, and so on, vary among the different types of materials in Maya. For example, if the texture requires a shiny surface, such as chrome, use a Phong material rather than something like a Lambert.

For a detailed description of a surface material's attributes, see "About surface materials" on page 311.

Displacement material

The displacement material lets you use an image to specify surface relief on objects in your scene. To find out more about surface relief, see "About surface relief" on page 111.

Volumetric material (atmosphere)

In the real world, when you photograph an object, it is usually within an atmosphere (air) and is surrounded by other objects (background).

Volumetric materials describe the physical appearance of phenomena which occupy a volume of space (for example, fog, smoke, dust or other fine particles). You can raytrace volumetric materials and produce effects such as displaying light fog through mirror reflections and refractions.

For a description of volumetric materials see "About volumetric materials" on page 351.

To use volumetric materials, see "Simulate fog, smoke, or dust" on page 141.

Layered shaders

You can layer shaders when you want to use more than one material for an object. Layered shaders let you create the appearance of variations in the material qualities of the surface by combining two or more material nodes that each have their own qualities. Layered shaders render more slowly than other materials, so consider using Layered textures instead to achieve similar results.

To use a layered shader, see "Layer shaders" on page 71.

For a description of the Layered Shader node's attributes, see "Layered Shader" on page 323.

Layered textures with the Layered Shader node

The Layered Shader has an attribute called *compositing flag* that causes the shader type to layer materials or layer textures. You can use this to layer textures with the Layered Shader node. However, using the Layered Texture node is recommended because you can set many more options. See "Layered textures" on page 30 for more information.

If you choose the texture option for the compositing flag, you must plug the whole network into a material (for example, Phong or Blinn).

For a description of this flag, see the Layered Shader node's attributes in "Layered Shader" on page 323.

Double-sided shaded surfaces

Double-sided shading lets you shade a surface with one material on one side and a different material on the other side. This is the only way you can apply more than one material to a NURBS surface. You use both the Condition and Sampler info utility to create this effect. For more information on these utility nodes, see "About General Utilities" on page 472.

To create double-sided shaded surfaces, see "Create double-sided shaded surfaces" on page 72.

Maya textures

2D and 3D textures

Texture nodes are a type of render node that, when mapped to the material of an object, let you define how the object's surface appears when rendered. For more info on render nodes, see "Render nodes" on page 24.

Texture node(s) (with the material node(s)) feed into the Shading Group node, which tells the renderer how to shade the surface. For more information on Maya's Shading Group node, see "Shading group node" on page 24.

Texture nodes are procedural textures generated by Maya or bitmap images imported into Maya (see "Procedural textures" on page 30) that you can use as texture maps for material attributes. Texture maps on various attributes such as color, bump, and specularity affect the appearance of the material. For more information about texture maps, see "Texture mapping" on page 34.

2D textures

2D textures wrap around an object, like gift wrapping, or stick to a flat surface, like wallpaper.

- For a detailed description of Maya's 2D textures, see "About 2D textures" on page 367.
- To map a 2D texture see, "Map a 2D or 3D texture" on page 74.
- To position a mapped 2D texture on an object see, "Position 2D textures and labels" on page 75.

3D textures

3D textures project through objects, like veins in marble or wood.

With a 3D texture, objects appear to be carved out of a substance, such as rock or wood. You can scale, rotate and move 3D textures interactively in a scene view to achieve the desired results.

- For a detailed description of Maya's 3D textures, see "About 3D textures" on page 389.
- To map a 3D texture see, "Map a 2D or 3D texture" on page 74.
- To position a mapped 3D texture on an object see, "Position 3D textures" on page 76.

Environment textures

Environment textures are commonly used either as backgrounds for objects in your scene or as reflection maps.

For more information on simulating reflections with environment maps, see "True reflections" on page 135.

For a detailed description of Maya's Environment textures, see "About environment textures" on page 408.

Layered textures

There are two ways to layer textures in Maya: using the Layered Shader with the texture compositing flag (see "Layered shaders" on page 28), or with the Layered Texture Node.

Though the workflow for using the Layered Texture node is similar to the Layered Shader, using the Layered Texture node is recommended because you can set many blend modes.

To use the Layered Texture Node to layer textures, see "Use a layered texture" on page 77.

Procedural textures

Procedural textures are generated by Maya. In fact, all of Maya's 2D textures (except for file and movie) and 3D textures are procedural textures.

Procedural textures are 2D or 3D plots of mathematical functions (called procedures) that have no limitation in resolution (size). You can adjust attributes for different aspects of a procedural texture to create different looks. 2D procedural textures operate much like 2D file textures in that they attach themselves to the UV coordinates of the geometry. 3D procedural textures ignore UV coordinates.

File textures

File textures are bitmaps scanned from photographs, taken with a digital camera, or painted in a 2D or 3D paint package that you bring into Maya to use as a bitmap. File textures filter better than most procedural textures and can result in better image quality.

Note You can render an entire branch of a shading network to use the illumination, shadow, shading, and textures as a file texture (texture map) for the following reasons:

- To reduce rendering time of particularly complex networks or if mental ray's high-profile global illumination features are involved.
- To obtain lighting effects that would be difficult to achieve in other ways.

For more information see "Baking illumination and color" on page 147.

Considerations for creating file textures

Animated file textures

To use a sequence of image files to create an animated file texture, the file extensions must be separated from the basename and, or the extension by periods. For examples, see "Image Name" on page 372.

Note Using "." to delineate animated file texture names may cause the wrong frame to be used for texture mapping.

Maya parsable, animated file textures should be of the form `XXX.ext.###`, where `XXX` is the filename, `ext` is an optional file extension (`.sgi`, `.tif`, `.iff`, and so on), and `###` is the frame number.

It is also possible to use file textures of the form `XXX.###.ext`. We do not support `XXX###.ext` (without the "." between `XXX` and `###`), nor `XXX.YYY.###.ext` (but `XXX_YYY.###.ext` is fine).

File textures for hardware rendering

In general, when rendering with file textures, take into consideration how much space the texture takes up in screen space. Larger textures (in one or both dimensions) use a lot of memory and take longer to render because the hardware renderer must spend more time reducing their size. Try to keep textures as small as possible when rendering. This substantially decreases rendering time and memory usage and may result in better quality (fewer aliasing problems and texture crawling).

Note	On Apple® Mac OS® X, file textures larger than 1K are not supported.

Tileable file texture images

Like any other texture, you map a file texture to an attribute of a material (shader). You can map file textures as a tileable (repeating) image where the opposing edges of the texture line up.

Procedural textures are tileable by default, but if you want to tile (repeat) file textures, you must make sure edges match properly to prevent seams. To make sure edges match properly, you can use an image editing package to offset the image, then touch up light or dark areas in the offset tile.

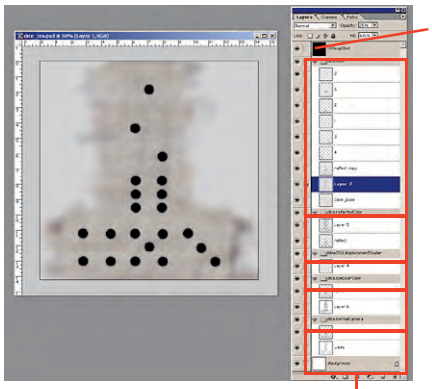
A tileable bitmap image is one that can be broken down into smaller pieces. Tileable images load faster and easier by the renderer, saving valuable rendering time. For more information on how to reduce the load on RAM during render time by converting your textures to Block Ordered Textures (tiles), see ”Cache texture tiles using BOT (block ordered texture)” on page 144 in the *Rendering* guide.

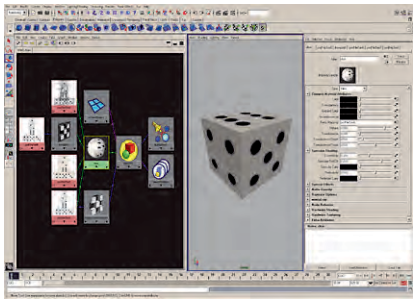
Square vs. non-square bitmap images

You want your texture to fit your model perfectly, as though the texture has been painted on. You could measure the surface to which the texture is attached. However, because Maya is more efficient if it scales any non-square texture into a square texture, using a square image to begin with is recommended. If the object you are texturing is not square, for example, a lamp pole, place your texture in a black square.



Adobe Photoshop texture networks





...and see them in Maya

(For Maya Software, Maya Hardware, and mental ray renderers.)

Adobe® Photoshop® files (version 6.0+) are supported, facilitating simple painting workflows in the following ways:

- You can use any existing Adobe Photoshop file as a texture in Maya, anywhere you would normally apply a texture.
- You can convert a PSD file with layer sets to a Layered Texture in Maya to help visualize and work with the individual layer sets.
- You can create a layered PSD file from within Maya in order to paint multiple channels (color, bump, specular, and so on) separately on an object, in Adobe Photoshop.
- You can use Maya's 3D Paint Tool to sketch out ("lipstick") an object to act as guidelines for the areas on the Adobe Photoshop image that should be painted, useful when UVs are inappropriate or unavailable to be used as a guideline.
- At anytime, you can modify a PSD file in Adobe Photoshop, then update the image in Maya to see the modifications immediately.

Related topics

❖ "Use PSD Networks as textures in Maya" on page 89
❖ "Create a PSD file with layer sets from within Maya" on page 90
❖ "Edit PSD Networks" on page 93

- ”Convert a PSD node to a file texture” on page 93
- ”Adjust conversion options” on page 94
- ”Open a PSD network in Adobe Photoshop from Maya” on page 92
- ”Sketch out guidelines (“lipstick”) for paint application” on page 92
- ”Update PSD Networks” on page 95

Texture filtering

Texture filtering is an anti-aliasing technique used to refine file textures, reduce flickering, or to achieve special effects. The File texture’s Filter attributes (see ”File” on page 370) scale the size of the filter and let you specify the amount of blur in the texture map.

If a texture map image is too sharp, it may reveal aliasing (staircase) effects in the final rendered image. By default, Filter is set to a value of 1.0 to help prevent such aliasing effects.

The effect of Filter is related directly to eye space. As the object moves further away from the eye, the more the texture blurs.

Multipixel filter plug-ins

(For Maya software renderer only.)

Multipixel filters process the entire rendered image to help eliminate artifacts, such as aliasing or jagged edges in rendered images, or roping or flicking in rendered animations. You can choose from a few different types of multipixel filters or you can create and use your own plug-in.

To create and use your own plug-in, see ”Create and load a plug-in multipixel filter” on page 88 in the *Rendering* guide.

Mapping and positioning textures

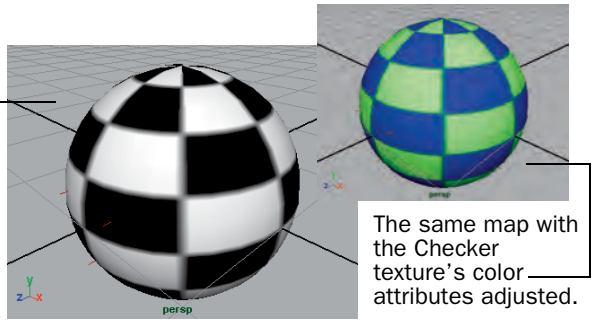
Texture mapping

Maya has a number of textures that you can map onto objects. For more information on these textures, see ”2D and 3D textures” on page 29.

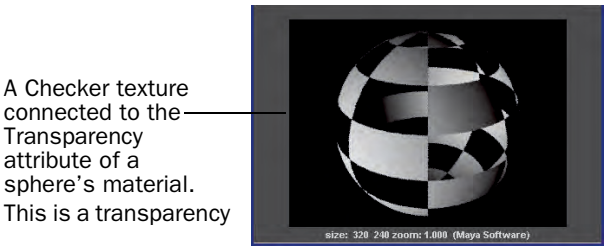
To apply a texture to an object you map (connect) it to the attributes of an object’s material. (Textures and materials are render nodes. Render node attributes describe how the node appears and behaves; for more information, see ”Render nodes” on page 24.) The attributes to which the texture is connected determines how the texture is used and therefore how it affects the final results.

For example, if you connect Maya's 2D black and white Checker texture to the color attribute of an object's material, you have applied a color map; the checkered pattern determines which parts of the object appear black and which appear white (or other colors if you adjust the texture's color attributes).

To map a texture, see "Map a 2D or 3D texture" on page 74.



If you connect the black and white Checker texture to the transparency attribute, you have applied a transparency map; the checkered pattern determines which parts of the object are opaque and which are transparent.



For a description of how textures stick to materials of objects, see "Mapping methods" on page 36.

Commonly used texture maps

To map a texture, see "Map a 2D or 3D texture" on page 74.

Color maps

By mapping a texture to the Color attribute of an object's material, you create a color map which describes the color of the object.

To learn more about how you can work with color in Maya, see "Color" on page 20.

Transparency maps

By mapping a texture to the Transparency attribute of an object's material, you create a transparency map which lets you make parts of an object opaque, semi-transparent, or entirely transparent.

To learn more about how you can work with transparency in Maya, see "Transparency" on page 20.

Specular maps

By mapping a texture to the Specular attribute of an object's material, you create a specular map which lets you describe how shine appears on objects (by controlling highlight).

To learn more about how you can work with highlight in Maya, see "Specular highlight (shine)" on page 21.

Reflection maps

By mapping a texture to the Reflected Color attribute of an object's material, you create a reflection map which lets you describe how an object reflects its surroundings.

To learn more about how you can work with reflection in Maya, see "True reflections" on page 135.

Bump maps

By mapping a texture to the Bump attribute of an object's material, you create a bump map which lets you add the illusion of surface bump detail to a surface.

To learn more about bump maps in Maya, see "Bump maps" on page 112.

Displacement maps

Displacement maps let you add true dimension to a surface at render time, a process which may reduce or eliminate the need for you to create complex models.

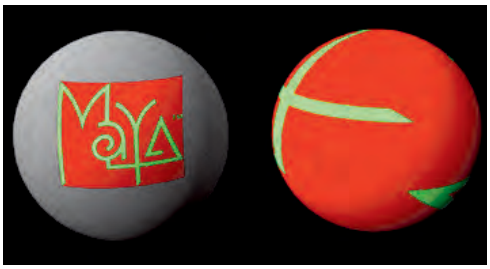
To learn more about how you can work with displacement maps, see "Displacement maps" on page 113.

Mapping methods

Mapping methods determine the relationship between the texture and the surface. For information on how to use different mapping methods, see "Transfer Maps" on page 40.

Normal mapping (default)

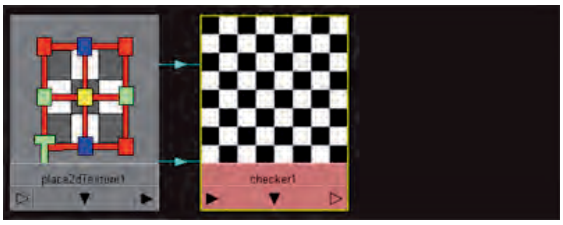
When you map a 2D texture, you can choose the mapping technique Maya uses to apply the texture to the object: normal, projection, or stencil. Mapping techniques determine the relationship between the texture and the surface. By default, textures are mapped as a normal map.



Normal mapping Projection mapping

The texture is mapped to the UV space of the surface and is sized and positioned depending on the UV parameterization of each surface. See the Polygonal Modeling guide for more details.

The shading network for a Normal 2D texture map is made up of the file texture node and the place2DTexture node that defines the texture's placement.



Projection mapping

This mapping technique projects the texture through 3D space like a slide projector.

When you create a projected 2D texture, it behaves like a 3d texture (it has height, width, and depth).

The shading network for a Projection 2D texture map is made up of the file texture node and a Projection node that defines the texture's placement.

Stencil mapping

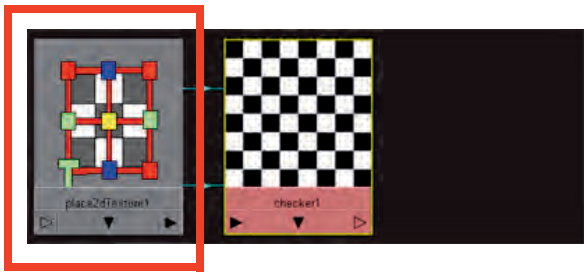
This technique lets you use either a mask file or a color key to remove part of the texture. If your label is not square, project the texture as a stencil to knock out the label using either a mask file or by color keying the texture. Then use the texture's Color Balance > Default Color to set or map the color behind the label.

The shading network for a Stencil 2D texture map is made up of the texture and a Stencil node that defines the masking, and two place2DTexture nodes: one for the texture, and one for the stencil.

2D and 3D texture positioning

2D texture positioning

A 2D placement node in a shading network defines a texture's positioning and orientation within the UV space of the geometry.



The 2D placement can result directly from the surface's UV space or indirectly through a projection node (if the texture is projection mapped).

You can scale (repeat), move (position) or rotate a place2DTexture to change how the texture appears on the surface to which it is mapped. Other values, such as coverage and default color let you specify how much of the surface area is covered by the texture frame and the color of the border that surrounds the texture (which happens only if the coverage is set to less than 1), respectively.

- To position 2D textures, see ”Position 2D textures and labels” on page 75.
- For a description of the place2dTexture node, see ”Place 2d Texture” on page 420.
- To change the default operation of the place2dTexture from label mapping to surface placement (which adjusts the contents of the label instead), see ”Texture placement vs. label mapping” on page 39.

Shared 2D texture node placement

Different textures can connect to one place2DTexture node so that they are positioned identically. Edits to the place2dTexture node affect all of the textures to which it is connected. Sharing textures with color, bump, specularity, and other maps that need precise placement is recommended.

To learn about node connections, see ”Render node connections” on page 26.

3D texture positioning

A 3D placement node defines a 3D texture or Environment texture's positioning and orientation in world space. 3D placement nodes make it easier to texture multiple surfaces as if they were one.

You can reposition 3D textures with numerical precision in the place3dTexture node's Attribute Editor, or you can use manipulators to reposition textures or labels interactively.

Maya provides two methods to place 3D textures on NURBS surfaces—Interactive Placement or Fit to group bbox (bounding box). Select the method most suitable for your needs. Sometimes using both methods works best.

When you create a 3D texture or project a texture onto an object (rather than apply it as a normal or as a stencil), a cube-shaped icon appears in the scene that corresponds to the size, scale, and location of the texture on the surface. Especially for animated or deforming objects, you must maintain the correct positioning of the texture on the object. (If the object is animated, you could parent the 3D icon to the geometry, for example.)

To position 3D textures, see "Position 3D textures" on page 76.

Texture placement vs. label mapping

By default, the Texture Placement tool is set for Label Mapping, which lets you stretch, shrink, move, and rotate the texture as if it were a label. You can change set the tool for Surface Placement, which lets you stretch, shrink, move, and rotate the texture as if it were wallpaper.

In both cases, wrap U and wrap V control the tiling of the texture in horizontal and vertical directions (based on the UV coordinates on the object).

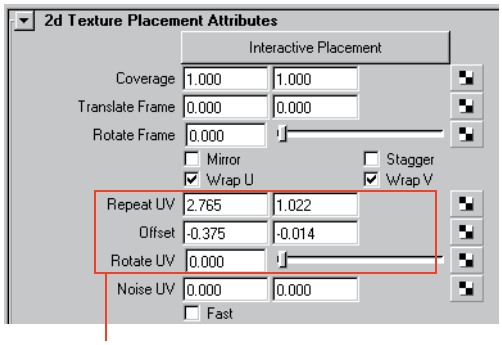
To change the Texture Placement Tool, double-click the Texture Placement Tool icon in the toolbar, or select Texturing > NURBS Texture Placement Tool > ❐.

Surface placement

When you drag the manipulator handles, the attribute settings for Repeat UV, Offset, and Rotate UV change in the place2dTexture's Attribute Editor. This lets you stretch, shrink, move, and rotate the texture as if it were wallpaper.



As you middle-drag the small boxes...



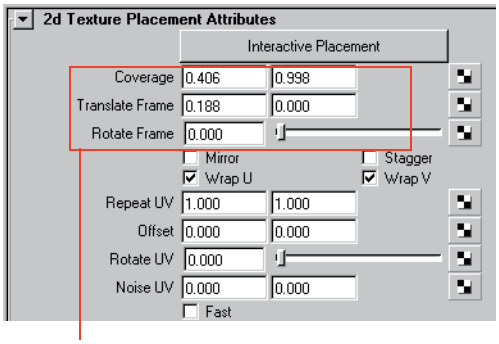
... these attribute settings change

Label mapping

When you drag the manipulator handles, the attribute settings for Offset, Translate Frame, and Rotate Frame change in the place2dTexture's Attribute Editor. This lets you stretch, shrink, move, and rotate the texture as if it were a label.



As you middle-drag the small boxes...



... these attribute settings change

Transfer Maps

You can transfer mesh characteristics from one mesh to a texture map on another with the *Transfer Map tool*. The Transfer Map tool creates a texture map of the mesh attributes of one object (source) and then bakes that map to the mesh geometry of another object (target). Use the Transfer Map tool to generate normal maps and other texture maps like displacement and light maps.

The most common application of this tool is in the creation of high-performance, real-time models where some mesh detail cannot be adequately represented within the polygon limit required.

Mapping techniques determine the relationship between the texture and the mesh. The texture maps created in the Transfer Map tool are wrapped around the target mesh of an object so that the patterns in the map curve and distort in a realistic manner.

For example, you can generate a normal map from a high resolution object and then bake that map to the mesh of a low resolution object to make the low resolution object *appear* to have a high resolution.

This is useful when you want to create a game-friendly model with the look of a high quality film model or when you want to reduce the number of calculations for the objects in your scene.

The Transfer Map tool is located in the Lighting/Shading menu (Lighting/Shading > Transfer Maps).

Notes

- All Transfer Map source and target objects must have clean, non-overlapping UVs.
- NURBS and Subdivision Surfaces are not supported as source or target meshes. The Transfer Map tool can only generate texture maps for polygonal geometry.
- If you want to render your normal map in mental ray for Maya, you must save the normal map in one of the supported formats (EXR, Maya IFF, JPEG, MI, PNG, YUV, RLA, SGI, PIC, TIM, TGA, BMP).

  In addition, you must turn on the *Maya derivatives* option in the Render Settings > mental ray tab > Translation > Performance section. For more information, see "Render Settings: mental ray tab" on page 290 in the Rendering guide.

Related Topics

❖ "Create texture maps with the Transfer Map tool" on page 81
❖ "Mapping methods" on page 36

Hardware shaders

About hardware shaders

Maya includes two hardware plug-ins that you can use to create hardware shaders, CgFX, and ASHLI (Advanced Shader Language Interface).

To see CgFX and ASHLI shaders, you must have a supported video card. As well, your Scene View must be in hardware textured mode.

Only the hardware renderer can render these hardware shaders.

Important You should only use graphics cards that are qualified for Maya and the ASHLI plug-in (support for HLSL and GLSL). Check the Autodesk website (www.autodesk.com/qual-charts) for the most accurate information about qualified hardware.

If you try to load the ASHLI plug-in with unqualified hardware, an error message appears and the plug-in is not loaded.

Plug-in limitations

You cannot use CgFX or ASHLI shaders that contain certain effects in Maya:

- Global effects
- Multi-pass effects

Shaders that deform geometry are not supported.

Related Topics

- "CgFX shaders" on page 42
- "ASHLI shaders" on page 43

CgFX shaders

The compiled CgFX plug-in in Maya lets you create hardware shaders.Previously, you may have downloaded the Cg / CgFx libraries from nVidia® . For more information, see "About hardware shaders" on page 41.

Note This plugin uses Cg 1.4. The cg compiler (cgc) and all dlls are included in the bin directory of Maya.

Older effects support a different syntax `.fx` (MS) files than the current ones: `.cgfx`. Because Cg is a superset of HLSL, CgFX 1.4 exposes all the capabilities of Cg (Interfaces and unsized arrays). Therefore, CgFX 1.4 has a new format called `.cgfx` that allows developers to program in the Cg language.

If you've installed an older version of CgFX, you must uninstall it or disable the environment variables that are set with the install.

Basic workflow

The following steps outline the basic workflow to use the CgFX plug-in.

- Load the CgFX plug-in from the Plug-in Manager.
- In Hypershade, create an CgFX Shader material.
- In the scene view, assign the CgFX material to an object.
- In the Attribute Editor, connect a `.cgfx` file to the CgFX Shader material.

- Adjust attributes, if necessary.
- In the scene view, turn on Hardware Texturing.

To create and work with a CgFX shader, see "Work with CgFX shaders" on page 98.

CgFX limitations and other notes

Important information about the CG language including the limitations of the CgFX plugin are available on the nVidia website (www.developer.nvidia.com), especially www.developer.nvidia.com/object/cg_toolkit.html.

ASHLI shaders

You can use FX files containing HLSL (High Level Shading Language) and GLSL (SGI® OpenGL® Shading Language) shaders in Maya, with the ASHLI plug-in. You can load this plug-in from Maya's Plug-in Manager. ASHLI is available for Microsoft® Windows® and Linux® operating systems only.

The ASHLI plug-in makes a shading material available in Hypershade which contains an attribute that you can connect to an FX file. The plug-in then loads this FX file and displays any settings as attributes in Maya's Attribute Editor. In the scene view, you'll see the ASHLI shader when you enable Hardware Texturing.

Currently, the ASHLI plug-in supports file textures, 2D textures, and cube maps. To use the ASHLI plug-in, you'll need a graphics card that supports fragment and vertex shaders under OpenGL. One of the following graphics cards are required:

- ATI FireGL V series
- ATI FireGL X series
- NVidia Quadro FX series

For more information, see "About hardware shaders" on page 41.

Basic workflow

The following steps outline the basic workflow to use the ASHLI plug-in.

- Load the ASHLI plug-in from the Plug-in Manager.
- In Hypershade, create an Ashli Shader material.
- In the scene view, assign the Ashli Shader material to an object.
- In the Attribute Editor, connect an FX file to the Ashli Shader material.
- Adjust attributes, if necessary.
- In the scene view, turn on Hardware Texturing.

To create and work with an ASHLI shader, see "Work with ASHLI shaders" on page 100.

ASHLI Limitations

Important information about the limitations of ASHLI are available on the ATI website (www.ati.com).

How do I? Build shading networks

Overview of building shading networks

Building a shading network typically consists of the following:

- "Open and navigate Hypershade" on page 44.
- "Create a node" on page 53.
- "Show node connections" on page 56.
- "Set node attributes" on page 65.
- "View the Shader Library Gallery" on page 68.

Open and customize Hypershade

Open and navigate Hypershade

Updated

For more information on the Hypershade, see "Hypershade window" on page 278.

To open Hypershade

Select Window > Rendering Editors > Hypershade from Maya's main menu bar.

To navigate Hypershade

To customize swatches in Hypershade

- Use the Hypershade tab toolbar to view the swatches as icons  or to view the swatches as text  .
- In the Hypershade tab toolbar, select among four swatch sizes: small, medium, large, and extra large.

   small

 medium

 large

 extra large

- In the Hypershade tabs, dolly in (using the Alt + the right mouse button, or Alt + the left mouse button and the middle mouse button) to flip through the swatch sizes.
- Sort your swatches by name  , by type  , by creation time  , or in reverse order  using the icons in the Hypershade tab toolbar.

To customize your work area

Updated

- In the Work Area, zoom or track using the same view navigation methods you use in the scene view.
- Use the Show Previous Graph  and Show Next Graph  in the Hypershade main toolbar (or the hotkeys "[" and "]" respectively) to step back and forth through networks that you have previously graphed.
- Use  to clear the current layout or  to rearrange the current layout.
- To see render node connections, choose among  Input Connections,  Input and Output Connections, and  Output Connections. For more information, see ”Show node connections” on page 56.
- You can group nodes by creating a container node. Selecting the nodes and choose  . A node container is created.
- Remove a container node by selecting the node and selecting  .
- For each node container, you can display all contents of the container by selecting the node and choosing  .
- Alternatively, for each node container, you can also hide all contents of the container by collapsing it. Select the node, then choose  .

General

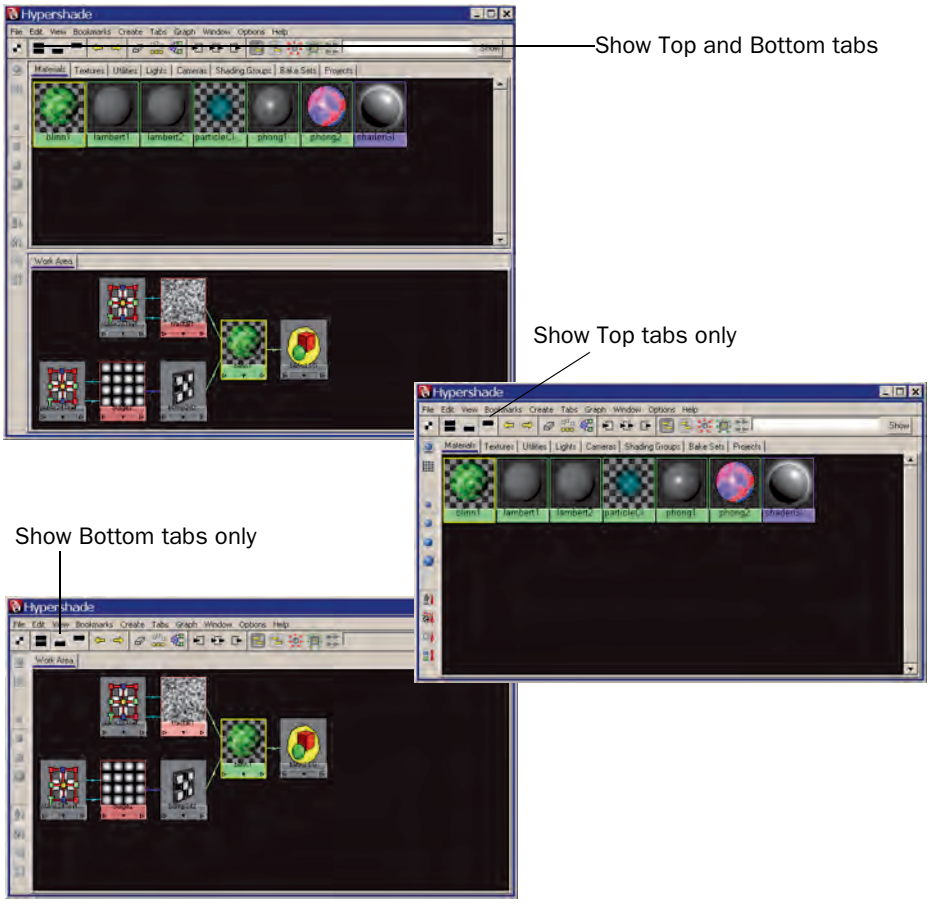
- Use the  icon to hide or display the Create bar.
- You can show only the top tabs (containing the rendering components) or only the bottom tab (Work Area tab). For more information, see Show top and bottom level tabs.

- If you can't see the swatch names in the panel, either zoom in, or drag the cursor over the swatches to display the swatch names.
- Shift-click to select more than one swatch.
- Double-click a node to show its attributes in the Attribute Editor.

Show top and bottom level tabs

For more information on the Hypershade, see "Hypershade window" on page 278.

You can view shading networks within tabs in a split panel display (the default) or in separate panels by selecting the buttons at the top-right of Hypershade. These items are also accessible in the Tabs menu.



Hide shape and transform nodes in Hypershade

Hypershade automatically displays all shape and transform nodes that are connected to various types of shading nodes (Shading Engine, Switch nodes, for example).

Often, you want to view only those shapes and transforms that influence a shading network and not those that happen to be in the Shading Group to express set membership. You can suppress the display of shapes and transforms in Hypershade to simplify a cluttered Work Area or to reduce the amount of time it takes for Hypershade to refresh.

To control the display of shapes and transforms

1. In Hypershade, select Options > Display (Work Area Only), then specify the options.
2. Regraph to see the change.

No Shapes

No shapes are displayed in Hypershade.

All Shapes except Shading Group members

Only shapes that are directly connected to shading nodes are shown. Shapes that are only connected to the Shading Group are not shown.

All Shapes

All shapes are displayed, including ones that are connected to the Shading Group only for the purpose of expressing set membership.

Transforms

Transforms are shown.

The display of transform nodes in Hypershade is controlled by the "Transforms" flag in the object's Attribute editor.

Create Hypershade tabs

For more information on the Hypershade, see "Hypershade window" on page 278.

Hypershade's tabs contain the nodes that make up the current scene. Click a tab to view specific nodes.

To create a new tab in Hypershade

1. Select Tabs > Create New Tab.
2. Enter the name of the new tab. This name appears on the new tab in Hypershade.

Tip	Use names that indicate the content of the tab.

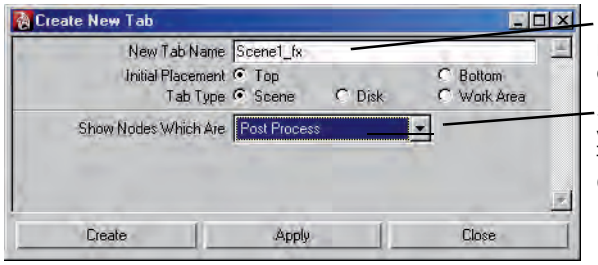
3 For the Initial Placement, select either the Top or Bottom option to view the new tabs at either the top or bottom panels of Hypershade.

4 Select a Tab Type and specify the corresponding options:

Scene	Displays a collection of nodes in the current scene. When you select this tab, you must specify an option from the Show Nodes Which Are drop-down list.
Work Area	Displays shading networks that are in the scene depending on the mode you choose: Input, Output, or Input and Output Connections.
Disk	Displays files and, or directories on disk. When you select this tab type, the Create New Tab window expands to display the “Root Directory” option.
Show Nodes Which Are	For Scene tabs, select to display only certain node types within a specified tab.
Root Directory	For Disk tabs, either type the path name if you know it, or click the folder icon to browse through directories to select the directory where the items are stored.
Only Show Files (Hide Directory Tree)	For Disk tabs, turn this on or off to hide or show the directory tree. This is especially helpful if you find you routinely work with files located in one specific directory. You can switch between viewing directory folders or just the files within that directory.

5 Click Create.

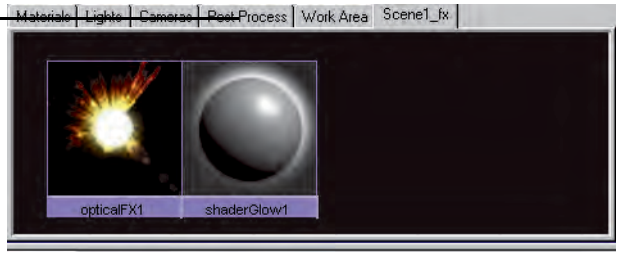
For example, if you want to create a tab that displays only the special effects nodes of the scene, name it appropriately, select Post Process from the list, then click Create. Hypershade displays the Post Process nodes in the scene.

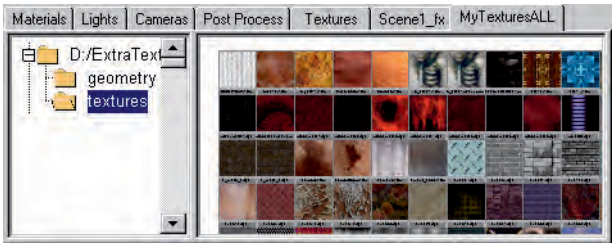


Enter a name that reflects the tab's content.

Select the type of nodes you want displayed in the tab, then click Create.

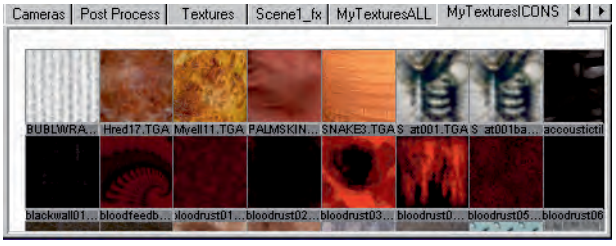
In Hypershade click the new tab to display the selected type of nodes in the current scene.





Both the nodes and directory tree display in Hypershade.

When on, only files within the specified directory appear.



Hide, resize or customize the Create bar

For more information on the Hypershade, see "Hypershade window" on page 278.

Do any of the following:

- Hide or show the Create bar by clicking the button in the Hypershade toolbar, or select Create Bar > Show Create Bar from the Options menu.
- Resize the Create Bar by clicking the << and >> buttons at the bottom of the Create Bar panel.
- The Options menu also provides items to customize the icon display. Select either Options > Create Bar > Display Icons and Text (the default) or Display Icons Only.

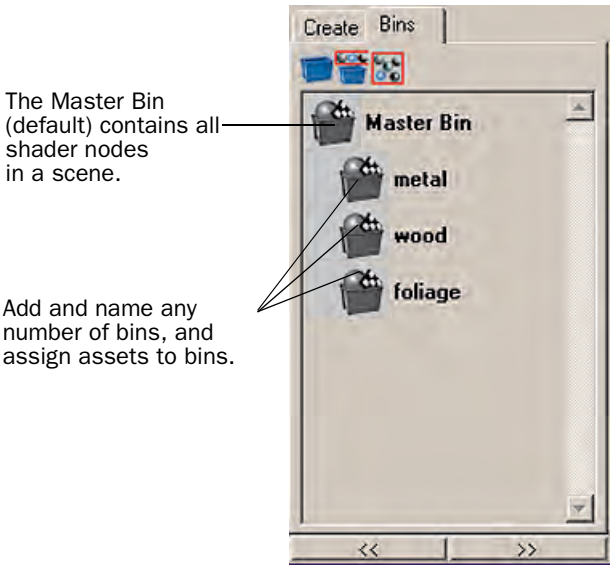


Display icons and text



Display icons only

Organize render nodes with Hypershade sorting bins



Sorting bins, which are containers for shading nodes (materials, textures, and so on), have been added to Hypershade to help you organize and track shading nodes in your scenes.

A default Master bin contains all shading nodes in your scene. You can add any number of additional bins to a scene and assign nodes to one or more of those bins. By strategically naming the bins, (for example, wood, metal, doors, foliage), you can quickly and more easily locate shading assets to work with them.

Notes

- When a node is assigned to a bin, all the shading nodes upstream to this node are also assigned to this bin.
- The Hypershade asset tabs (Materials, Textures, and so on) exist for all sorting bins, allowing for further organization and filtering.
- While shading nodes can be assigned to more than one bin, they are not duplicated in the scene.

To select (see the contents of) bins

When you select one or more bins, you can see the contents of the bins.

- To select and see the contents of one bin, click the bin.
- To select multiple bins, do one of the following:
  - Shift+click a range of bins.

    - Ctrl+click each bin you want to select.
- Ctrl+click a bin to toggle between selecting and deselecting it.

To create a new empty bin

1. In the Hypershade Bins tab, click the Create Empty bin button. The New Bin Name window appears.
2. Type the new name, then click OK. A new empty bin appears.

To create a new bin with selected content

1. Select the assets you want to add to a bin.
2. In the Hypershade Bins tab, click the Create bin from selected button.

To rename a bin

1. In Hypershade, double-click the bin you want to rename.
2. Type the new bin name and press Enter.

To duplicate a bin

1. In Hypershade, right-click the bin.
2. Select Duplicate. The bin is duplicated and all the same assets are assigned to it.

To select assets

- To select one asset, click the asset.
- To select multiple assets, do one of the following:
    - Marquee drag across the assets.
    - Shift+click to switch between selecting and deselecting an asset.
- To select assets that are not assigned to a bin, in the Hypershade Bins tab, click the Select unsorted content button.

To add assets to a bin

In Hypershade, do one of the following:

- Select the assets you want to add to a bin, then right-click bin and select Add Selected.
- Select the assets you want to add a bin, then middle-drag them to the bin.
- To add a single asset to a bin, drag it to the bin.

To make assets exclusive to one bin

This procedure removes selected assets from all other bins.

1. In the Work Area, select the assets you want to make exclusive to one bin.
2. Right-click any existing bin.

3 Select Make Selected Exclusive.

To remove some assets from a bin

1 Select the assets you want to remove from a bin.
2 Right-click the bin.
3 Select Remove Selected.

To remove all assets from a bin

Right-click the bin, then select Empty.

Change default connection line colors

For more information on the Hypershade, see "Hypershade window" on page 278.

For more information on node connections, see "Render node connections" on page 26.

To change the default color of connection lines

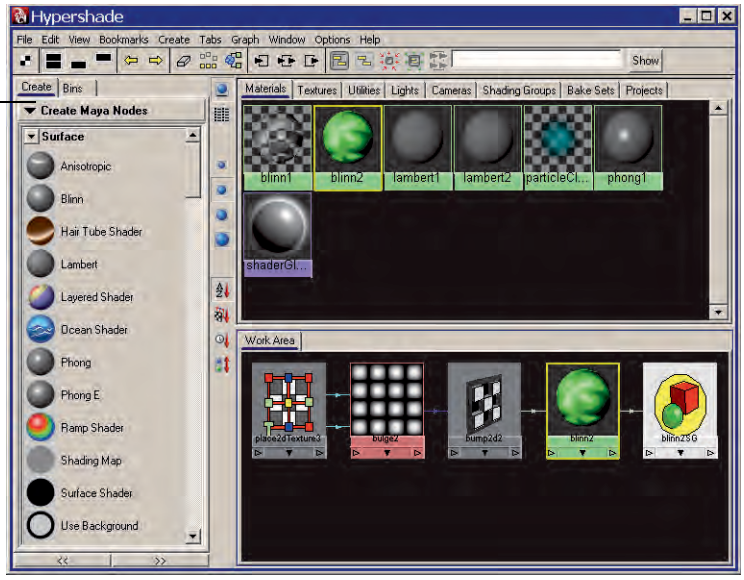
1 In the Maya main window, select Window > Settings/Preferences > Color Settings to open the Colors window.
2 Open the Hypergraph/Hypershade section to view a list of the default connection colors.
3 To change the colors, drag the sliders or click the color swatch to open the Color Chooser and select a color.

Create nodes

Create a node

For more information render nodes, see "Render nodes" on page 24.

In Hypershade, you can click to choose the type of node you want to create.



For more information on the Hypershade, see ”Hypershade window” on page 278.

To create a node

Do any of the following:

- Middle-drag a node from the Create Bar into the Hypershade panel or onto another node in the Work Area.

  If you drop the new node onto another node, a connection pop-up menu may appear. Select an attribute on which you want to connect a node, and release the mouse button. Hypershade displays the new node swatch and the material swatch updates. For more information about render node connections, see ”Render node connections” on page 26.

- Select Create > from Hypershade’s menu bar to access the “Create > Create Render Node” items.
- Middle-drag a node from the Create Render Node window.
- Right-click in a panel and select a node from the pop-up menu.

Tips

If you want a clear the Hypershade Work Area every time you drag a new node into Hypershade, turn on Options > Clear Before Graphing. This is helpful especially if you have large networks with many nodes and you want to work on just one node or a smaller section of the network. You can select the node you want to work on and graph upstream or downstream connections to show you just that section without having to look at the rest of the network.

For more information on the work area, see "Work Area tab (bottom tab)" on page 284.

Duplicate a node

For more information about render nodes, see "Render nodes" on page 24.

To duplicate a node and its network

1. Select the node you want to duplicate.
2. In Hypershade, select Edit > Duplicate > Shading Network. Maya creates the duplicated shading network in Hypershade with the original node. Each node you duplicate is placed in the appropriate directory.

Tips

- If you want to duplicate a node without its network, select the node and select Edit > Duplicate > Without Network.
- If you want to duplicate a node and connect it to the same network (in effect sharing the network), select Edit > Duplicate > With Connections to Network.

Delete a node and its network

For more information on render nodes, see "Render nodes" on page 24.

For more information about shading networks, see "About shading networks" on page 23.

To delete a node and its network

1. Click the node you want to delete (marquee-select or Shift-click to select more than one node).

   The associated node swatches are highlighted.
2. Press Backspace (Windows, and Linux®) or Delete (Mac OS X) to delete the node(s).

   The swatches in Hypershade are deleted.

Import and export shading networks

Use the import or export options in Hypershade's File menu to import and export rendering networks among scenes (see "Hypershade window" on page 278). You can also import rendering networks into the current scene by dragging them from the project directory.

For more information about shading networks, see "About shading networks" on page 23.

To import a rendering network

Drag the network you want from the Project tab directory into the Work Area. The network swatch appears in Hypershade's Work Area.

To import all networks from another scene

Open the scenes directory in the Project tab and middle-drag a Maya scene file into the Work Area.

Maya imports all the nodes from that scene into the current scene.

To export a rendering network

1. In Hypershade, select the node(s) you want to export.
2. Select File > Export Selected Network.
3. Select the folder you want to export to, and choose Export. (You can also export all the nodes in the scene by selecting File > Export All in the main Maya window.)

Connect nodes

Show node connections

For more information about render nodes and connections, see "About shading networks" on page 23.

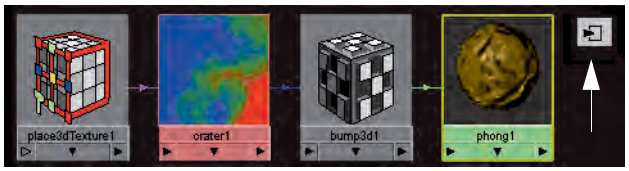
To show connections

Select the node for which you want to see the connections, then click one of the following icons on the Hypershade main toolbar. (Point to an icon to display its name.)

Note	Input and output connections are sometimes called upstream/ downstream connections.

Input Connections

 Displays the input connections of the selected node. Input connections are those Maya automatically creates depending on the node type.



Output Connections

 Displays the output connections of the selected node. Output connections show the Shading Group Node. Double-click the Shading Group swatch to open its Attribute Editor.



Input and Output Connections

 Displays both the input and output connections of the selected node.



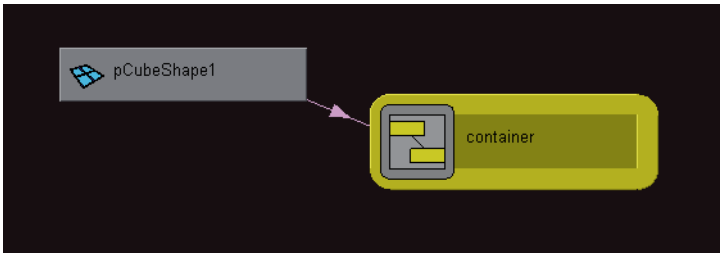
Assemble nodes into logical groupings using container nodes in the Hypershade

New

You can arrange your Work Area in the Hypershade in a more efficient manner by assembling nodes into logical node groupings using *container node*s. For example, if you have a complex shading network that appears multiple times within your scene, you can group each network into a container to obtain a simpler Work Area.

A container node is a special type of node that lets you simplify the display of nodes related to a particular item in the scene or lets you assemble multiple nodes for a special purpose.

A container node is differentiated from other nodes in the Hypershade by its thick, round-cornered border outline.



Container nodes do not change the hierarchical (parent/child) relationships between nodes. You add and modify attributes and make attribute connections on container nodes just like you would other nodes in Maya. For more information see ”Create, edit, or delete custom attributes” on page 102 and ”Connect input and output attributes” on page 112 of the *Basics* Guide.

You select nodes within container nodes in exactly the same way you select other nodes in the Hypershade.

Creating and modifying container nodes

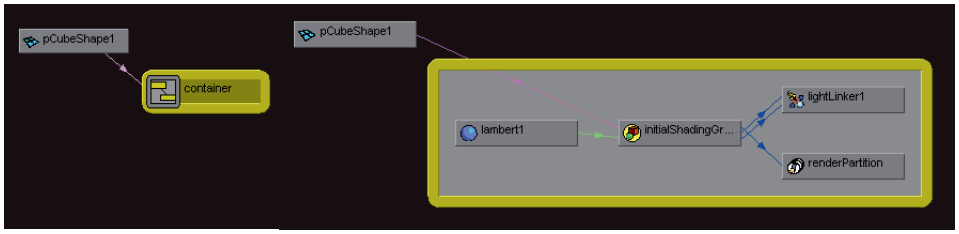
Container nodes can be created and removed using the Hypershade’s Edit menu or by using the icons on the Hypershade Toolbar.



Create, remove, expand or collapse container nodes using these icons in the Hypershade toolbar.

You can expand or collapse the display of container nodes by double-clicking on the container node’s border or by using the icons in the Hypershade Toolbar. Expanding a container node lets you view the nodes contained within it. Collapsing a container node reduces the display of its contents so they appear as a single node in the graph display. Collapsing and expanding a container node does not affect its contents, nor does it affect the connections and attributes of the nodes inside the container node.

The background of an expanded container node is semi-transparent so you can see nodes that are behind it. Attribute connections in and out of container nodes are also visible.



Container node collapsed Container node expanded

To create a container node in the Hypershade

Select the nodes you want to place in the container node and then do one of the following:

- From the Hypershade menu, select Edit > Create Container.
- Select the  icon in the Hypershade toolbar.
- Right-click one of the selected nodes and choose Create container from selected on the marking menu.

A container node is created in the Work Area of the Hypershade, and the selected nodes appear within it.

To remove a container node from the Hypershade

Select the container node you want to remove and then do one of the following:

- From the Hypershade menu, select Edit > Remove Container.
- Select the  icon in the Hypershade toolbar.

The selected container node is removed from the Work Area of the Hypershade. Any connections that existed for the removed container are deleted in the process.

Note	Removing a container node does not remove any of its contents or change the internal connections among nodes.

To collapse the display of the contents of a container node

Select an expanded container node the display of which you want to minimize and then do one of the following:

- From the Hypershade menu, select Edit > Collapse Container.
- Select the  icon in the Hypershade toolbar.
- Double-click the border on the expanded container node.

The selected container node is minimized. It is approximately the size of a regular node.

To expand a container node to display its contents

Select a container node the contents of which you want to view and then do one of the following:

- From the Hypershade menu, select Edit > Expand Container.
- Select the  icon in the Hypershade toolbar.
- Double-click the border on the collapsed container node.

The selected container node is expanded in size to display the nodes contained within it. The container node automatically resizes to contain its nodes.

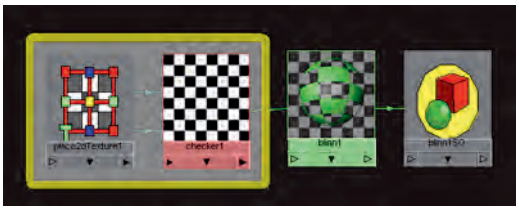
To add or remove nodes from a container node

Press Alt + Shift and drag the node into or out of the container node. The node is added or removed from the container.

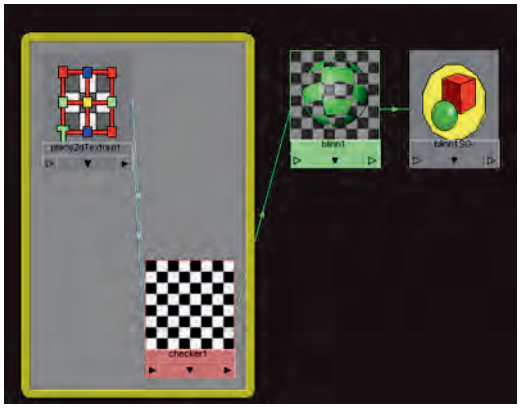
Tip	You can also remove a node from an existing container node by right-clicking the node and selecting *Remove from container* on the marking menu.

To modify the size of your container node

You can increase the size of your container node by moving its contents. The container node stretches as its contents is moved. If you collapse this node and expand it again, the last node position is restored.



Container node size created by default



Drag the checker1 node to stretch the size of the container node

Related topics

- ”Hypershade window” on page 278
- ”Create, edit, or delete custom attributes” on page 102 in the *Basics* guide.
- ”Connect input and output attributes” on page 112 in the *Basics* guide.

Connect render nodes using their default connections

For more information about render nodes and connections, see ”About shading networks” on page 23.

To automatically connect nodes

If you drag and drop rendering nodes on top of each other, Maya automatically connects them in a default way. The default depends on the type of node. For example:

- Middle-mouse button drag a 2D or 3D texture swatch over a material to automatically connect the texture’s output color to the material’s output color.

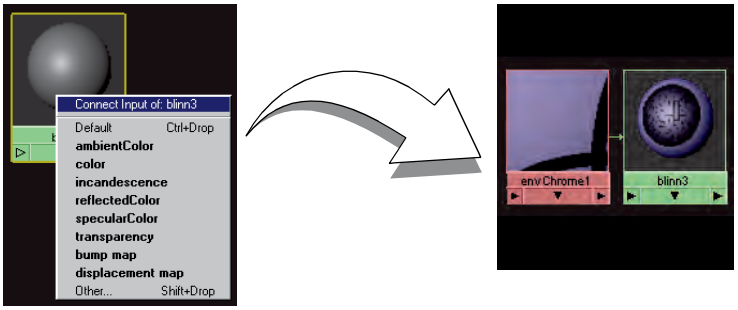
- Middle-mouse button drag a Bump2d General utility node over a material node to automatically connect the bump map to the material's Bump Mapping attribute.

Connect default output to a specific input attribute

For more information about render nodes and connections, see "About shading networks" on page 23.

To connect two rendering nodes using a default output and explicit input connection

1. Middle-drag a node from within Hypershade, the Create Render Node window, the Create Bar, or from the Shader Library, onto a node in Hypershade. The Connect Input menu of the receiving node appears.
2. Select the input attribute from the pop-up menu to make the desired connection.

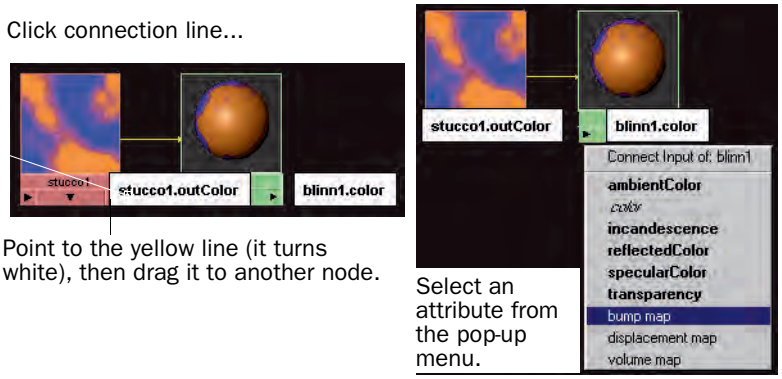


Connect render nodes by dragging existing connection lines

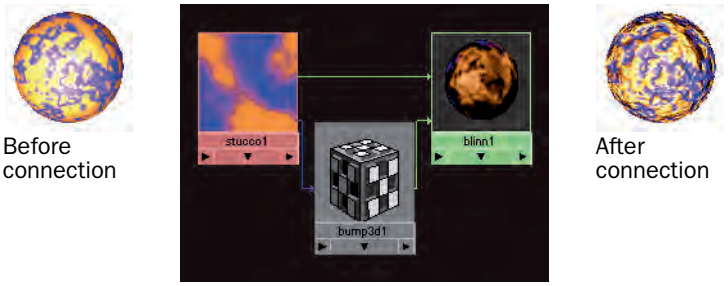
For more information about render nodes and connections, see "About shading networks" on page 23.

To connect attributes using connection lines

1. Click the connection line.
2. Drag one end of the connection line (it turns white when you point to it) to the material to which you want to connect the node, then select an attribute from the Connect Input menu.



Maya makes a new connection, a new line and new node displays, and the material updates with the new connections.



Connect render nodes using the Connection Editor

Updated

For more information about render nodes and connections, see ”About shading networks” on page 23.

To open the Connection Editor

Do one of the following:

- Click Window > General Editors > Connection Editor.
- Double-click a connection line.
- Shift+middle-mouse button drag a node onto another node in Hypershade.

To connect rendering nodes in the Connection Editor

In the Connection Editor, select the output attribute on the left, and the input attribute on the right to connect the nodes.

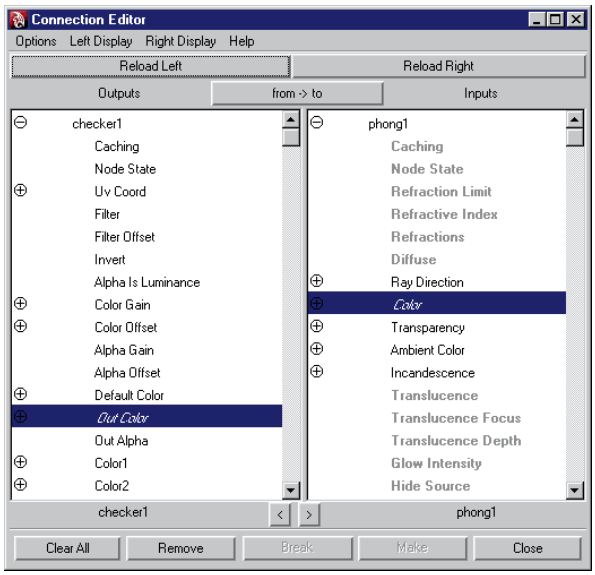
When you select an output attribute, some of the input attributes on the right are dimmed, indicating either that they cannot be connected to this type of output node or you must double-click the dimmed attributes to see the nested, connectable nodes.

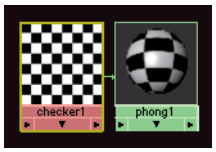
To connect two object's nodes using the Connection Editor

New

1. Select the object for the output source.
2. Shift+click the object for the input source. The order is important since the second object selected always acts as the input source.
3. Select Window > General Editors > Connection Editor.

   The Connection Editor window opens and the left and right columns are automatically filled with the attributes of each source.





For more information on the Connection Editor, see "Connection Editor" on page 275.

Change existing render node attribute connections

For more information about render nodes and connections, see "About shading networks" on page 23.

1. Do one of the following to show the Connection Editor:
   - Drag a node over a material swatch
   - Double-click the connection line between nodes.

2 Select an item from the Outputs column (for example, a utility node you selected), then select an item from the Inputs column (the material attributes) to connect them.

Delete a render node connection

For more information about render nodes and connections, see "About shading networks" on page 23.

To delete a node connection

1 Click the connection line(s) you want to delete (marquee-select or Shift-click to select more than one).

The lines are selected.

2 Press Backspace (Windows, and Linux) or Delete (Mac OS X) to delete the connections.

The lines are deleted and the swatches in Hypershade update to show the changes.

Adjust node attributes

Set node attributes

For more information about render nodes and their attributes, see "About shading networks" on page 23.

For a detailed description of the material node attributes, see "About surface materials" on page 311, "About displacement material" on page 350, "About volumetric materials" on page 351.

You can adjust one node at a time (for example if you want to adjust an individual attribute while using IPR), or you can adjust several nodes at the same time using the Attribute Editor, Attribute Spread Sheet, the Rendering Flags window, or the Channel Box.

To set an attribute for one node

1 Select the node whose attribute you want to adjust and open its Attribute Editor (double-click the swatch in Hypershade to open its Attribute Editor, or select Window > Attribute Editor).

2 Adjust the attribute by moving the slider or typing a value in the field next to the attribute name. If you want to map a texture, utility, or optical effect, click the map button at the end of an attribute's name.

To set attributes for multiple rendering nodes in the Attribute Spreadsheet

1 Select the surfaces or rendering nodes whose attributes you want to adjust.

2 Select Window > General Editors > Attribute Spread Sheet.

3 Click a tab heading to see the attributes.

- The Keyable tab contains the render node attributes.
- The Render tab contains the attributes that determine how a surface renders.

4 Use the scroll bar to view the attributes horizontally.

5 Drag down an attribute column to select its contents and select the top field to select all the entries in the column.

6 Type the value you want in the top field of the selected attribute column and press Enter (Windows, and Linux) or Return (Mac OS X).

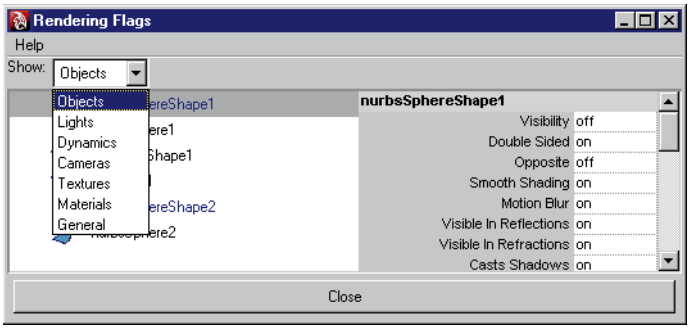
All the attributes in the column update with the new value.

To set attributes for nodes in the Rendering Flags window

1 Click Window > Rendering Editors > Rendering Flags.

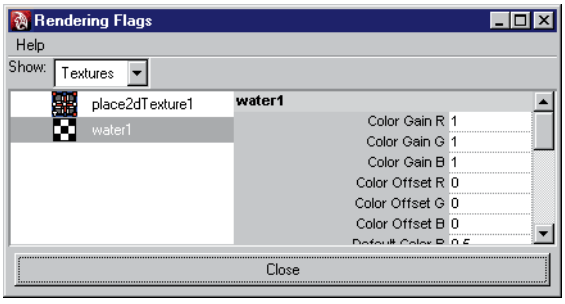
2 In the Rendering Flags window, from the Show drop-down list, select the item(s) for which you want a list of attributes.

The attributes for these items are listed in the right panel where you can change and set them, much like in the Channel Box.

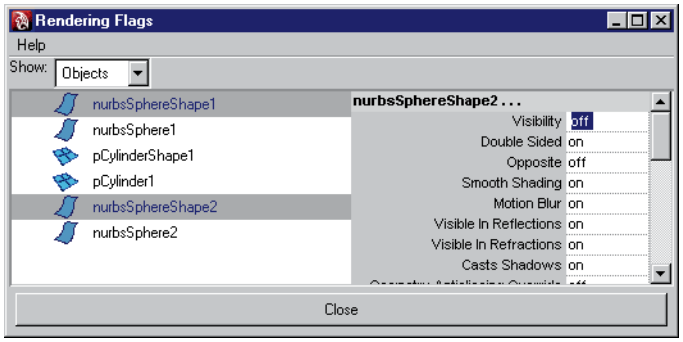


3 Do one of the following:

- To change the attributes of one node, click the listed node in the left panel to display the attributes in the right panel, then change the attributes.



- To change attributes for several related objects by selecting them in the left panel of the Rendering Flags window, and setting the attribute value in the right panel. For example, if you want to turn the visibility off for two NURBS spheres in the scene, select both spheres from the left panel and type **off** beside Visibility in the right panel.



Once you change an attribute for a selected item, the heading changes color in the list, reminding you of the change.

Tip You can also set an attribute for multiple nodes using the Render Flags window or the Channel Box.

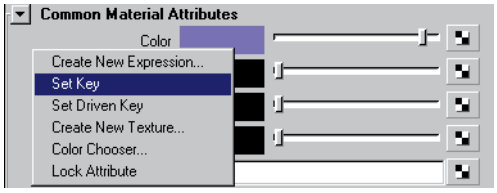
Animate a node attribute

For more information about render nodes and their attributes, see ”About shading networks” on page 23.

For a detailed description of the material node attributes, see ”About surface materials” on page 311, ”About displacement material” on page 350, ”About volumetric materials” on page 351.

To animate an attribute

1. In Maya’s main window, set the Time Slider to a frame.
2. In the node’s Attribute Editor, right-click the label of the attribute you want to key, such as the Color attribute, and select Set Key from the pop-up menu to create a key.



3. Set the Time Slider to another frame.

4 Adjust the attribute and set another key. For example, click the Blinn material's color attribute and select a different color from the Color chooser each time you set a new key.

5 Playback the animation. The surface to which the rendering attributes are assigned animate in the view (for instance, the Blinn color changes at each key you set).

Work with shader libraries

View the Shader Library Gallery

For more information about shading network libraries, see "Shader network libraries" on page 24.

To view the Shader Library gallery

In the directory where you store the Shader Library, click the `readme.html` file or the `gallery.html` file to view these shading networks on your browser. Click an image to get a closer look and use the arrows to navigate.

Assign a shading group from the Shader Library

For more information about shading network libraries, see "Shader network libraries" on page 24.

To assign a shading group from the Shader Library

1 Click to open a folder, then middle-drag the swatch representing a shading network into Hypershade.

2 To view how the shading network is connected, select the swatch, then click the Input and Output Connections button to graph the shading network into the Work Area tab.

3 To assign the shading network to an object, middle-drag the material swatch over the object in the view.

Note	By default, the material type for the shading networks is PhongE. To achieve different results, you may want to change the Material type (by selecting a new Type in the material's Attribute Editor). When you do this, however, some of the material attributes change which requires you to manually reconnect some parts of the network.

Create and assign materials to surfaces

Create a material

For more information about Maya materials, see "Surface, displacement, volumetric materials" on page 27.

For more information about mental ray for Maya shaders, see "mental ray for Maya custom shaders" on page 162 and "mental ray for Maya nodes" on page 423.

Use one of the following methods to create a material in Hypershade:

- Right-mouse button click in Hypershade, then select a material from the pop-up menu (Create > Materials).
- Select a material from the Create menu in the menu bar.
- From the Create Bar, middle-drag a material swatch into Hypershade.
- Select a material from the "Create Render Node window" window.

To open the Create Render Node window

Do one of the following:

- Click the map button  next to an attribute in an Attribute Editor.
- In Hypershade, select Create > Create Render Node.

Assign existing materials to surfaces

For more information about Maya materials, see "Surface, displacement, volumetric materials" on page 27.

The following lists a few quick ways to assign (connect) a material to a surface.

In the scene view, you can be in either wireframe or shaded mode to make the connection. If you are in wireframe mode, make sure the cursor touches the surface when you release the mouse button, otherwise the connection may not be made.

Assign a material to surfaces

You have several options to assign a material to a surface or surfaces.

To assign a material to a surface or surfaces (option 1)

Right-mouse button click the object(s), then click Assign new material.

To assign a material to a surface or surfaces (option 2)

1. In the view, select the surface(s) to which you want to assign the material.
2. From the Hypershade, middle-drag the material swatch over the selected surface(s).

To assign a material to a surface or surfaces (option 3)

1. In the view, Shift-select the object to which you want to assign the material, and in the Hypershade, click the material swatch.
2. While the cursor is over the material swatch in the Hypershade, right-click-drag to select Assign Material to Selection from the pop-up menu.

To assign a material to a surface or surfaces (option 4)

Middle-drag and drop a Hypershade swatch onto an object in the IPR Render View.

To assign a material to several surfaces

1. Select the surfaces in a view.
2. In the Hypershade, right-click over the material swatch and select Assign Material To Selection from the pop-up menu. Maya applies the material to the surfaces.

Assign a material to a group of faces on a polygonal surface

You have several options to assign a material to a group of faces.

To assign a material to a group of faces on a polygonal surface (option 1)

1. Right-mouse button click the surface.
2. Select Face from the marking menu.
3. Choose Select by component type icon (or press the hotkey F11).

To assign a material to a group of faces on a polygonal surface

1. Select (either drag or Shift-click) the faces you want to map.
2. In Hypershade, right-mouse button click the material you want to assign, then select Assign Material To Selection from the pop-up menu.

   Maya applies the material to the faces.

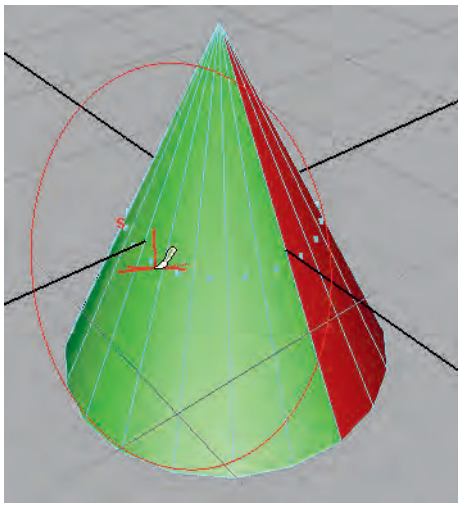
Assign shaders to polygon faces

You can assign a shader to faces on a polygonal surface using a Maya® Artisan™ brush. Use this feature to assign different shaders to faces of the same model (e.g. to texture a building that is part brick and part glass).

To assign a shader to faces on a polygonal surface using an Artisan brush

1. In the view, select the object to which you want to assign the material.
2. In the Hypershade (Window > Rendering Editors > Hypershade), right-click the material swatch and select Paint Assign Shader from the marking menu.

3 An artisan brush appears in your scene view. Drag your brush over the faces that you want to apply the shader to.



Paint Assign Shader allows you to assign a shader to faces using the artisan brush.

Tip	If your artisan brush selects vertices rather than faces, right-click your surface and select Face to convert to Face mode.

For more information about Maya shaders, see ”Surface shading” on page 19.

For more information about Artisan-based brushes, see ”Using Artisan brush tools” on page 9 of the *Paint Effects, Artisan, and 3D Paint* book.

Layer shaders

For more information on layered shaders, see ”Layered shaders” on page 28.

To create a layered shader (example)

1 Open the Layered Shader’s Attribute editor.

2 Create a Lambert shader and drag to the area with the green swatch in the Attribute Editor.

3 Create a Phong and do the same.

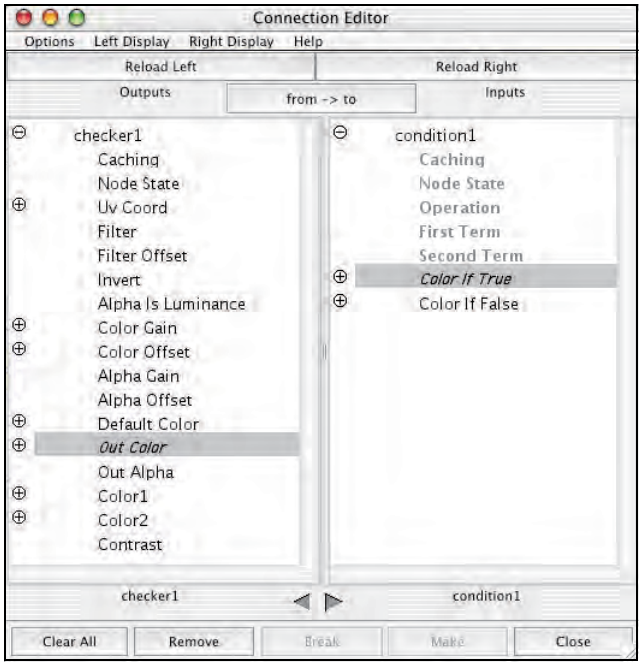
The leftmost shader is the topmost material. You’ll have to have some level of transparency to see the shader underneath. So, for this example, you’ll need to map the Lambert’s transparency channel with something to see the shiny Phong underneath. Then assign the shader to an object.

Create double-sided shaded surfaces

For more information about double-sided surfaces, see "Double-sided shaded surfaces" on page 29.

To create a double-sided shaded surface

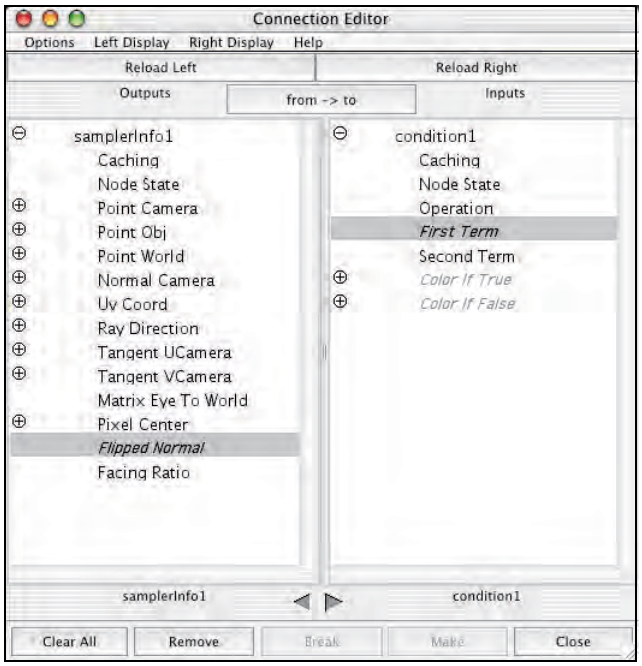
1. In the Hypershade, create one of each of the following:
   - Material (this procedure uses a Phong material).
   - A Sampler Info utility. The Sampler Info utility provides access to camera and surface information that you can pipe into your shading networks during rendering.
   - A Condition utility. The Condition utility lets you specify which texture is mapped to each side of the surface.
   - Checker texture.
   - Crater texture.
2. Assign the Phong material to the surface.
3. In the Hypershade, middle-drag the Checker texture onto the Condition utility to open the Connection Editor.
4. In the Connection Editor, connect the Checker's Out Color attribute to the condition utility's Color If True attribute (click the Out Color attribute in the Checker column, then click Color If True in the Condition column).



5 In the Hypershade, middle-drag the Crater texture onto the Condition swatch, and in the Connection Editor, connect the Crater's Out Color to the Condition's Color if False attribute.

6 Middle-drag the SamplerInfo swatch over the Condition swatch to open the Connection Editor.

7 In the Connection Editor, click the Flipped Normal attribute then click the Condition's First Term or Second Term attribute.



8 In the Hypershade, middle-drag the Condition swatch onto the Phong material swatch and select color to connect it to the Phong's Color attribute.

9 Perform a test render.

Maya shades each side of the surface with a different texture.

Swapping the textures on the surfaces

For more information about double-sided surfaces, see "Double-sided shaded surfaces" on page 29.

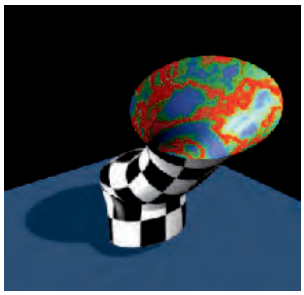
You can use the Condition utility to specify which texture is applied to the front and back sides of the surface. For more information about the condition utility, see "Condition" on page 475.

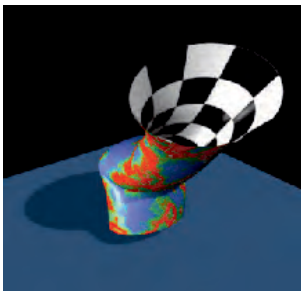
To swap texture mapping for double-sided shading

1 Double-click the Condition swatch in Hypershade to open its Attribute Editor.

2 In the Condition Attributes section, change the Operation attribute to Not Equal (or if it is set to Not Equal, change it to Equal).

3 Perform a test render. The following shows the result.





Note	You can apply more than one material to polygonal models at the face level.

Map and position textures

Map a 2D or 3D texture

When you map a 2D or 3D texture to an object, you connect it to an attribute of the object's material. Textures map to geometry based on the object's UV texture coordinates. For more information about texture mapping, see "Texture mapping" on page 34.

Unless you use a method that explicitly connects a texture to a specific attribute of the object's material, it connects to the material's default attribute (usually color or transparency). For more information on node connections, see "Render node connections" on page 26.

To map a texture using Hypershade

1 In the Create bar, make sure the Create Maya Nodes tab is shown.

2 Scroll to 2D Textures or 3D Textures.

3 For a 2D texture, select a mapping method (Normal, As projection or As stencil).

For information about mapping methods, see "Mapping methods" on page 36.

4 Do one of the following:

- From the Create textures bar, middle-mouse drag a 2D or 3D texture onto the desired object's material. You can drag either directly to the material in Hypershade, or to the object in the scene view.

The texture is placed on the object in a default position, and a placement node appears in the Hypershade. For more information on placement nodes, see "Place 2d Texture" on page 420.

Note When you middle-drag-drop a file texture on to a material and select Default in the pop-up menu, this automatically connects the `file.outColor` to the `material.color` and, if the image file has an alpha channel, connects the file.outTransparency to the material.transparency.

In versions previous to Maya 4.5, this connected the file.outColor to material.transparency. If you prefer the old behavior, you can disable the automatic connection of file.outTransparency to material.transparency in the situations described above. To do so, set the environment variable:

`MAYA_DISABLE_OUTTRANSPARENCY_CONNECT`

- In the Attribute Editor, click the map button next to the attribute to which you want to connect the texture. The Create Render Node window appears. See "Create > Create Render Node" on page 302.

Position 2D textures and labels

You can reposition 2D textures with numerical precision in the place2dTexture node's Attribute Editor, or you can use Maya's Texture Placement Tool to reposition textures or labels interactively.

For more information about texture positioning the place2dTexture node "2D texture positioning" on page 38.

To position a 2D texture interactively

1. In the Hypershade, click the place2dTexture swatch that is connected to the texture you want to reposition.

   The place2DTexture's Attribute Editor appears

Tip If you cannot see the place2dTexture swatch, do the following:

- Select the texture swatch, then click the Input Connections button on the Hypershade toolbar.
- If no place2DTexture swatch exists, it has been deleted or not created (because it's automatic creation has been turned off by default). You must add one (see "Create a node" on page 53), then connect it to the texture (see "Connect render nodes using their default connections" on page 61) before you can reposition it.

2 Do one of the following:

- Change the values of the attributes in the Attribute Editor. For detailed descriptions of the attributes, see "Place 2d Texture" on page 420.
- For NURBS, click the Interactive Placement button in the Attribute Editor to use the Texture Placement tool. To set the Texture placement tool, see "Texture placement vs. label mapping" on page 39.

Tip	It may be difficult to place a texture using only the manipulator. Use both the manipulator and the Attribute Editor to get the desired result.

Position 3D textures

For more information about texture positioning the place3dTexture node "3D texture positioning" on page 39.

To use the 3D placement manipulator

1 Assign a 3D texture to a surface.

The texture's place3dTexture node (swatch) appears in Hypershade and a manipulator appears in the view panel.

2 Double-click the node to open the Attribute Editor.

3 Select the Interactive placement (see "Interactive Placement" on page 487) to reposition the 3d texture to show the placement manipulator. (This tool similar to a combined version of the move, scale, and rotate tool.)

To use the Fit to group bbox option

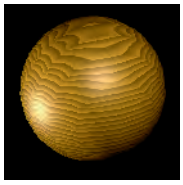
1 Assign a 3D texture to a surface.

The texture's place3dTexture node (swatch) appears in Hypershade and a manipulator appears in the view panel.

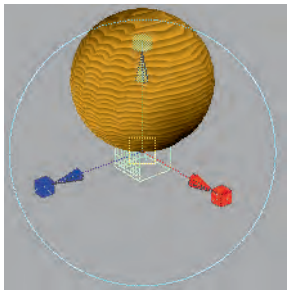
2 Double-click the node to open the Attribute Editor.

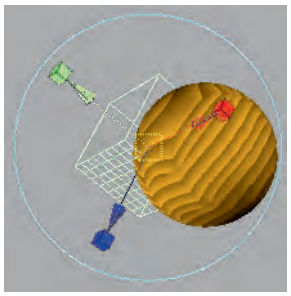
3 Select the Fit to group bbox to reposition the 3d texture. This causes the 3D texture to be scaled, moved, rotated as necessary to the assigned object's bounding box.

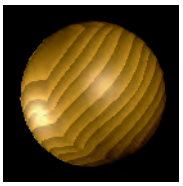
Interactive Placement



Wood texture applied to a sphere

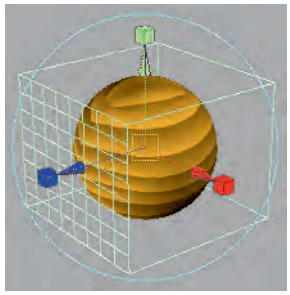


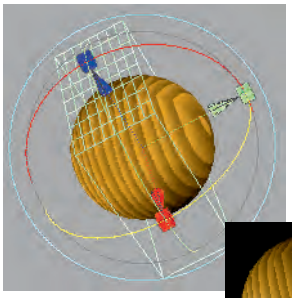




The result after adjustment.

Fit to Bbox







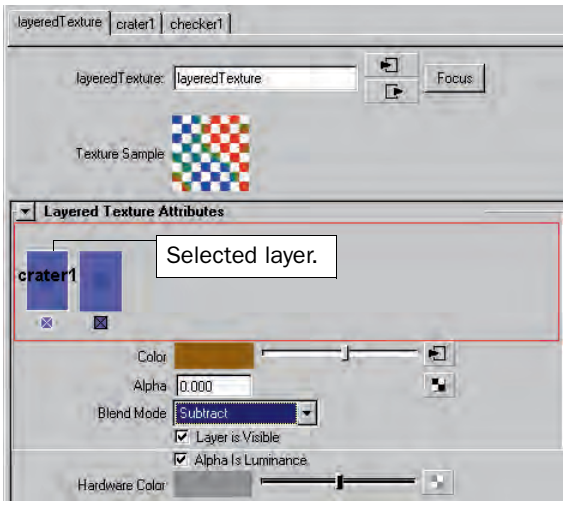
Tip	You can also use Maya's transform tools to position the Fit to group bbox manipulator.

Use a layered texture

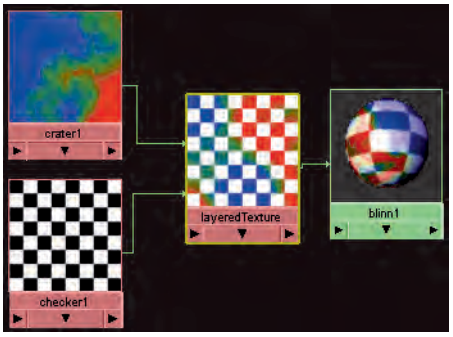
For more information on layered textures, see "Layered textures" on page 30.

To use a layered texture

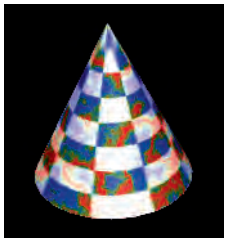
1 In the Layered Texture's Attribute Editor, select the layer you want to edit.



When you select a layer, Maya updates the Color, Alpha, Blend Mode, and Layer visibility attributes to reflect the properties of the selected layer.

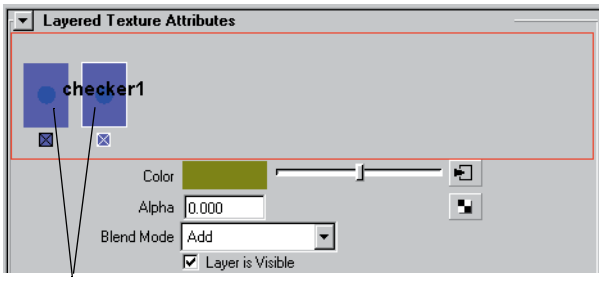


Hypershade view



Rendered result

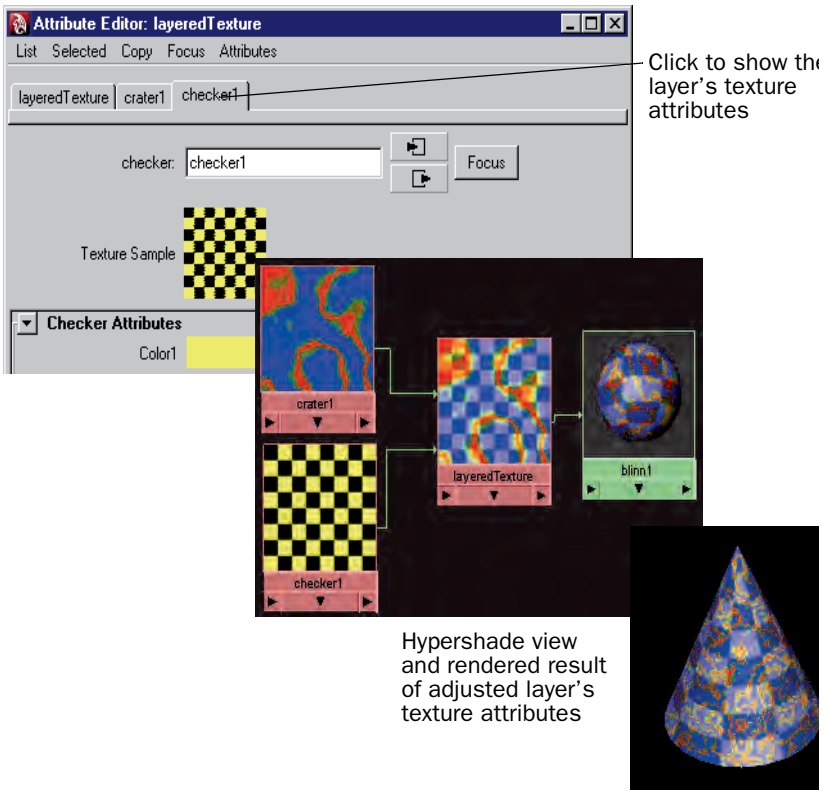
Tip	To re-order the layers in the Layered Texture's Attribute Editor, middle-mouse button drag the texture swatch.



Middle-drag these swatches to re-arrange layers

Tip	To change a layer's texture attributes, click the tab at the top of the Attribute Editor to access that texture's attributes.

2 Edit any of the attributes. For a detailed description of the attributes, see "Layered texture" on page 418.



Click to show the layer's texture attributes

Hypershade view and rendered result of adjusted layer's texture attributes

Create Texture Reference Object

You can create a texture reference object for the selected surface to lock a 3D texture or projected 2D texture to the surface. As the surface animates or deforms, the texture stays with the surface, producing a very natural looking result.

Note

- You must create a reference object before you animate or deform the original surface.
- A reference object for a polygonal surface must have the same topology (number of faces) as the original surface. When you create a reference object, the topology of the reference object is identical to the original surface. However, if you make subsequent changes to the topology of the original surface, you must create another reference object.
- A scene can contain any number of reference objects, but each surface in the scene can only have one reference object.

To create a Texture Reference Object

1. Select a surface and assign a 3D texture to it.

   If the 3D texture node is grouped within an object's hierarchy, see "Troubleshoot when I move a referenced object, the texture swims" on page 105.
2. Select Texturing > Create Texture Reference Object.

   Maya creates a templated copy of the surface called the reference object. You can move a reference object anywhere in the scene.
3. Use the texture placement manipulators to position the texture relative to the reference object.
4. Animate the original surface (not the reference object).

   As the original surface moves or deforms, Maya uses the reference object to move or deform the texture so that it matches the motion or deformation of the original surface.

Select and delete a texture reference object

To select a reference object

Do one of the following:

- Click Texturing > Select Texture Reference Object.
- Click the reference object's heading in the Channel Box.

To delete a reference object

Click Texture > Delete Texture Reference Object.

Convert a texture or shading network to a File Texture

When you convert illumination, shadow, shading, and textures to a file texture, you are performing a render; the process draws on the settings in Maya Software Render Settings (see "Render Settings window" on page 265 in the *Rendering* guide for more information). Be sure you set these settings to achieve the result you want.

Use this procedure when you map a procedural texture or shading network to a surface and want to change it to a file texture.

To find out more about file textures in general, see "Procedural textures" on page 30.

For more information on the difference between converting and baking, see "Baking illumination and color" on page 147.

For more information on a similar function in a mental ray renderer see, "Baking illumination and color" on page 147.

Tip	If you want to have raytraced information included when you convert a shading network to a file texture, you should use mental ray for Maya's conversion to do so. For more information, see "Lighting/shading > Batch Bake (mental ray)" on page 246, and "Baking to textures and vertices" on page 160.

To convert a procedural texture or shading network into a File texture

1. Shift-click the object in the view and the material swatch in Hypershade.
2. Do one of the following:
   - Select Edit > Convert to File Texture in Hypershade.
   - Click Edit > Convert to File Texture > ❐ , adjust the options, then click Convert Texture.

Create texture maps with the Transfer Map tool

Updated

Use the Transfer Map tool to create various types of texture maps. For more information, see "Transfer Maps" on page 40.

Notes

- All Transfer Map tool target objects must have clean, non-overlapping UVs.
- NURBS and Subdivision Surfaces are not supported as source or target meshes. The Transfer Map tool can only generate texture maps for polygonal geometry.
- By default, if multiple target objects are loaded in the Transfer Map tool, then a single map is generated for all the targets. However, if you want to create separate maps for each of your target objects, then you need to perform the Transfer Map bake operation for each target separately.
- You can use display layers or quick select sets to separate and keep track of your source and target meshes.
- You can use file referencing to bring high resolution geometry into your scene to be used as source meshes.

For a description of the Transfer Map tool options, see "Lighting/Shading > Transfer Maps" on page 253.

To create a map of one object's mesh attributes and then bake that map onto another object

1. Select Lighting/Shading > Transfer Maps.

   The Transfer Maps window appears.
2. In the scene view, select the object you want as your *target*. This is the object to which you want to bake the texture map.
3. In the Target Meshes section of the Transfer Map tool, click the Add Selected button.

   The object you selected in the scene view is now the current target for your object transfer map operation.
4. In the scene view, select the object that you want as your *source*. This is the object that has the mesh attributes for which you want to create a texture map.
5. In the Source Meshes section of the Transfer Map tool, click Add Selected.

   The object you selected in the scene view is now the source mesh for your transfer map operation. By default, all the unselected meshes in your scene are loaded as the source meshes.

Tip	A shortcut to this procedure is to first select the object that you want as your target and then select Lighting/Shading > Transfer Maps. This way, the object that you selected is automatically listed in the Target Meshes section of the Transfer Map tool. All other unselected meshes in your scene are also automatically loaded as the source meshes.

6 From the list of icons, select the types of *output map* you want to generate when you create your texture map and click on the appropriate icon.

See "Output maps" on page 255.

7 Set the output options for each of your texture maps.

If you plan to create several maps with the same width and height, you can reuse your settings by entering them in the Maya Common Output section (or mental ray Common Output section) of the Transfer Maps window.

Otherwise, if you uncheck the Use Maya common settings option (or Use mental ray common settings option) for your texture map, the Map width and Map height attributes appear in the texture map section that you are currently working on.

See "Maya Common Output" on page 265.

8 Select one of the following:

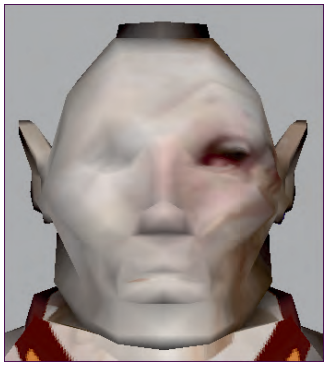
- Click Bake and Close if you want to generate the texture maps and then close the Transfer Maps tool.
- Click Bake to generate a texture map and leave the Transfer Map window open.
- Click Close to disregard any changes to the Transfer Map tool settings.

To create a normal map using the Transfer Map tool's default settings



High resolution mesh

Model by Ted Charlton



Low resolution mesh



Resulting normal map

Tips

- You can use display layers or quick select sets to separate and keep track of your source and target meshes.
- You can use file referencing to bring high resolution geometry into your scene to be used as source meshes.

1. Load your source and target meshes into a new Maya scene.
2. Make sure that your source and target meshes are positioned on top of each other in the scene view.
3. Select your target mesh in the scene view.
4. Select Lighting/Shading > Transfer Maps.

   The mesh you selected is automatically loaded as a Target and all other meshes in your scene are loaded as Sources.
5. In the Output Maps section, click on Normal from the list of icons to create a Normal map.
6. Set the following attributes in the Normal map section:
   - File name (Normal map field)

     This determines the name of the texture map file as well as where the map will be saved.
   - File format

     This determines the file format of the normal map you generate.

Note If you want to render your normal map in mental ray for Maya, you must save the normal map as one of the supported formats: EXR, Maya IFF, JPEG, MI, PNG, YUV, RLA, SGI, PIC, TIM, TGA, and BMP.

You must also turn on the *Maya derivatives* option in the Render Settings > mental ray tab > Translation > Performance section. For more information, see "Render Settings: mental ray tab" on page 290 in the *Rendering* guide.

   - Map Space

     Select Tangent Space.
   - Check the Use Maya common settings option so that you can share and reuse your settings when you create more than one map with the same width and height.
7. Scroll to the Maya Common Output section and expand the section to set your common map attributes. Set the following options:
   - Map width and Map height

     This specifies the resolution for the texture map.

Note	The Maya scene view only supports tangent space maps and they are only visible in the scene view when in High Quality Rendering mode.

- Select a medium Sampling Quality.
- Select Transfer in World Space.
- Keep the rest of the options at their default settings.

8 Scroll to the Connect Output Maps section to specify how the texture map you are going to create will be linked to the target mesh. To view the results of the texture map within Maya, enable *Connect maps to: New shader / Connect maps to: Assigned shader.*

9 Bake the normal map.

To create a left-handed tangent space normal map

In order to create a left-handed tangent space normal map, you must do the following:

1 Open the Attribute Editor for the target meshes' shape node.

2 Expand the Tangent Space section and select Left Handed under Coordinate System.

For more information regarding the left handed tangent space, see "Tangent Space" on page 286 of the Polygonal Modeling guide.

To create a custom search envelope

1 Select Lighting/Shading > Transfer Maps.

The Transfer Map tool appears in the scene view.

2 In your scene view, select the polygonal mesh that you want to define as your custom search envelope.

3 In the Target Meshes section, click Add Selected.

The selected mesh is loaded into the Transfer Map tool as a target mesh.

4 Right-click on the mesh's name In the Target Meshes section and select Use Selection as Envelope from the context-sensitive menu that appears.

The polygon mesh you selected is now the search envelope for your Transfer Maps operation.

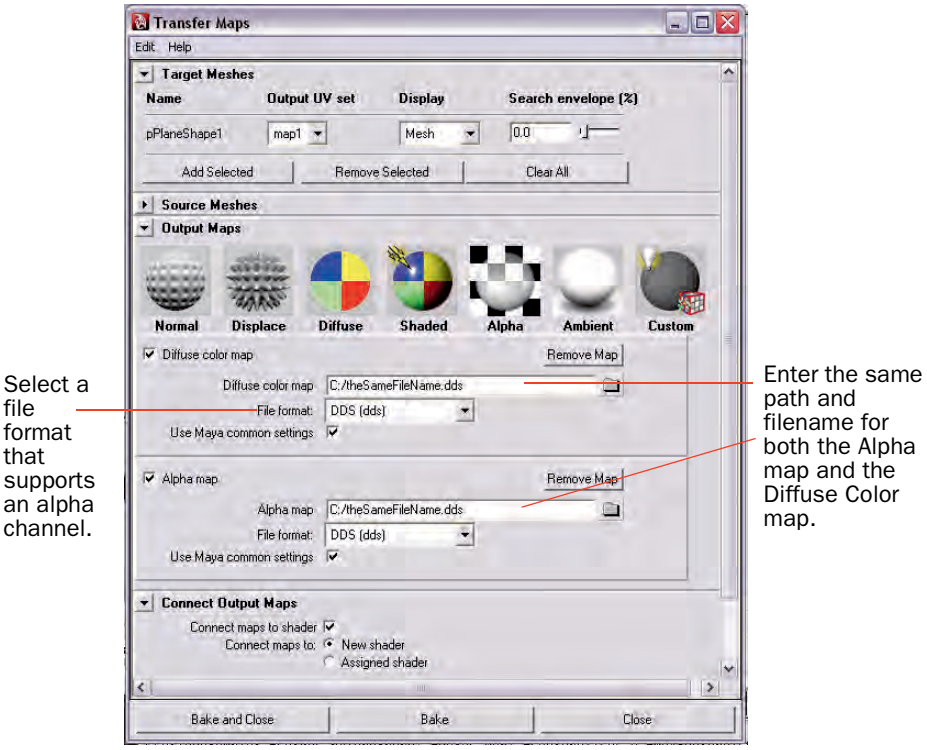
To create a texture map with an alpha channel

New

Transfer maps allow you to pack any scalar output (for example, alpha or displacement) into the alpha channel of the texture map being used for a vector output (for example, color or normal). Therefore, you can create, for example, a color map with alpha, or a normal map with displacement, or a color map with displacement, and so forth.

1. Select a file format that supports an alpha channel (for example, `.dds`, `.exr`, `.tif`).
2. Enter the same path and file name into the two output you want to combine into a single texture map. The path and file names are case sensitive.
3. Bake the map.

Note	If the Connect maps to shader option is enabled, Maya attempts to connect the combined map to the shader. However, many of the combinations that are generated using this method require a custom (hardware) shader for correct display in the scene view.

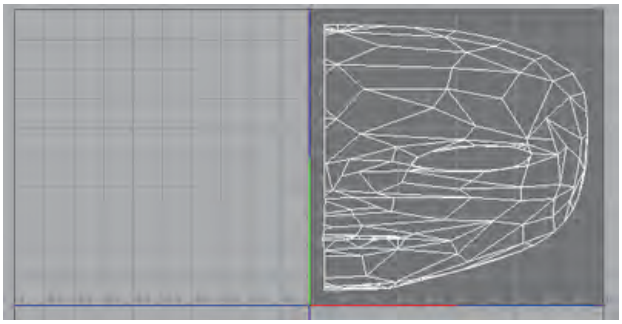


Creating and using mirrored normal maps on a character or object

New

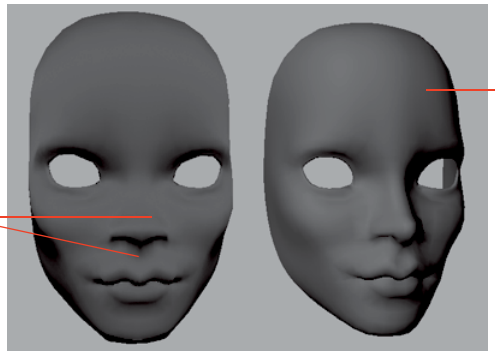
Mirroring a normal map across a character allows you to optimize texture usage where all of the normal map detail is symmetric around the UV axis. For example, the two arms of your character may share the same normal map.

If both halves of the geometry are rendered into the normal map on top of each other, the mirroring of the normals introduces artifacts into the combined result. Therefore, you need to specify which half of the geometry defines the normal map (and which half just uses it).



Both halves of the geometry are overlapped on top of each other in UV space.

Normal map baked onto low resolution object with artifacts. Details around the nose and mouth are washed out, and the normal map becomes meaningless.



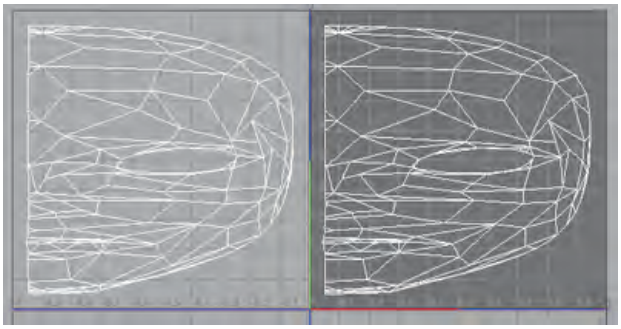
High resolution (source) object

Follow these steps to create your normal map.

Creating and displaying a mirrored normal map on a character or object

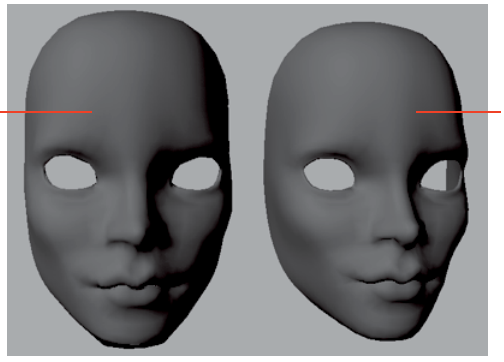
Option 1

1. Set the UV Winding Order of your object to Detect to ensure that both sides of your mirrored normal map are displayed correctly. For more information about UV Winding Order, see "UV Winding Order" on page 286 in the Polygonal Modeling guide.
2. Select the half of the object (for example, face) that you want to define the normal map for. Leave this half within the 0 to 1 UV range.
3. Move the other half of the object out of the 0 to 1 UV range so that it does not affect the generated normal map.
4. Bake the normal map using Lighting/Shading > Transfer Maps.



Move the other half of the object out of the 0 to 1 range and into the 0 to -1 range.

Select the half of the object that you want to define the normal map for and leave it within the 0 to 1 range.



Option 2

1. Set the UV Winding Order of your object to Detect to ensure that both sides of your mirrored normal map are displayed correctly. For more information about UV Winding Order, see "UV Winding Order" on page 286 in the Polygonal Modeling guide.
2. Select Lighting/Shading > Transfer Maps and enable the Ignore Mirrored Faces option under the Maya Common Output section. See "Ignore Mirrored Faces" on page 266 for more information.

Tips

- For best results, ensure that each side of your model has consistent UV winding. Otherwise, artifacts may appear.
- To avoid seams when mirroring normal maps on a character, ensure that the source geometry is symmetric. That is, one side of the character matches the other. This becomes particularly important when working with surface meshes that are derived from scan data.

Use Adobe Photoshop files in Maya

Use PSD Networks as textures in Maya

The PSD File node lets you use a PSD file as a texture network in Maya. It is similar to Maya's File texture node, but it's for PSD files only.



By default, Maya links a PSD file to the composite image, which is included in the PSD file. Maya can only read image and vector layers, so when the PSD node is linked to Adobe Photoshop's composite image (it is by default), Maya supports anything that Adobe Photoshop supports, including (for example) layer styles, adjustment layers, text, and so on.

However, you can choose to link the PSD node to a layer set instead, in which case layer styles and adjustment layers are not supported and should be rasterized before the PSD file is read in Maya.

The advantage of PSD files with layer sets

PSD files with layer sets facilitate iterative painting:

- Adobe Photoshop artists can add, modify, or delete any number of layers within a layer set while maintaining the connections in Maya (see also "Create a PSD file with layer sets from within Maya" on page 90).
- Maya artists can convert a PSD node to a Layered Texture, and see the layer sets as multiple PSD File Textures connected to a layered texture in Hypershade.

Note Maya treats all layers within a layer set as a single flattened image.

To use an existing PSD file in Maya

1. In Hypershade, load your PSD image file with the new PSD File Texture node (Create Maya Nodes > 2D textures > PSD File Texture).

   The PSD file is linked to Adobe Photoshop's composite image.
2. If the file has multiple mask channels, you can choose which one to see. Select the mask from the Alpha to Use attribute in the Attribute Editor.
3. If the PSD file has layer sets, you can choose a layer set to link to. Select the layer from the Link to LayerSet attribute in the Attribute Editor.
4. As with any File Texture in Maya, you can set any PSD File Texture attributes.

   See "File Attributes" on page 96.

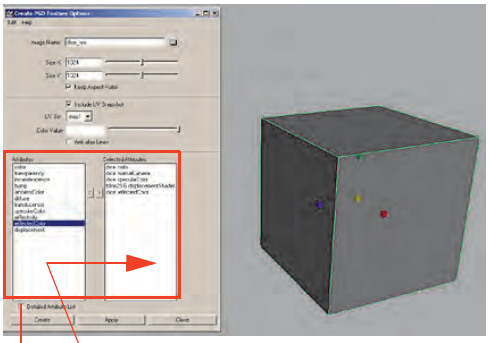
To convert an existing Adobe Photoshop File Texture with layer sets to a Layered Texture

1. In Hypershade, do one of the following:
   - Right-click a PSD File Texture, then select Convert to Layered Texture.
   - Select Edit > Convert PSD to Layered Network.
2. To see the multiple layer sets connected to the layered texture, regraph the layered texture.

Create a PSD file with layer sets from within Maya

When you create a PSD file from within Maya, you select the channels to be painted in Adobe Photoshop.

These channels are then represented in Adobe Photoshop as layer sets, and you can add, edit, or delete any layer within a layer set (see also "Use PSD Networks as textures in Maya" on page 89). Any changes you make in Adobe Photoshop are piped back into the appropriate channels in Maya when you update the PSD node (see "Update PSD Networks" on page 95).



Channels you select from the first column and add to the second column become layer sets in Adobe Photoshop.

For a detailed (advanced) list of attributes, turn on Detailed Attribute List.

Note	An optional UV snapshot works as a guideline to help you paint the texture with greater accuracy. You can create a UV snapshot when you create a layered PSD file in Maya (see "To create and use a layered PSD file in Maya" on page 91).

To create and use a layered PSD file in Maya

Make sure UVs fit within the 0 to 1 texture space (see the online documentation for details) and select the required material (like Phong, for example).

1. Select the object you want to paint.
2. Select Texturing > Create PSD Network.

   The Create PSD Network Options window opens.
3. Type the name of the Adobe Photoshop file to be created, and set any of the options (or use the default).

   For information on the options, see "Texturing > Create PSD Network" on page 271.
4. In the list of Attributes, double-click an attribute you want to paint to add it to the list of Attributes. Repeat for additional attributes you want to include. If you want to paint an attribute not shown in the list, turn on the Detailed Attribute List.
5. Select Create.

   An empty PSD file is created by Maya with layer sets for the selected attributes you want to paint. The background colors are taken from the material.
6. Locate the PSD file in the sourceimages directory of your project.
7. Open the file in Adobe Photoshop.

- Each attribute to be painted is represented by a layer set, and you can add or delete as many layers as you want within a given layer set. Maya treats each layer set as a separate flattened image, and the material's base color is used.
- If you opted to include a UV snapshot, it is inserted on the topmost layer as reference for painting. (This layer does not contribute to the render.)

8 Paint the layers in Adobe Photoshop, then save the file.

9 In Maya, select Texturing > Update PSD Networks.

Each of the PSD image file's layer sets are represented by a separate node attached to the PSD file node.

Open a PSD network in Adobe Photoshop from Maya

You can open a PSD network for editing or viewing from Maya.

Do one of the following:

- In the Create PSD Network Options window or Edit PSD Network Options window, turn on the *Open Photoshop* option.

  When you finish creating or editing the PSD network, Photoshop automatically opens with the selected file texture ready for editing.
- In the Attribute Editor for the PSD node (psdFileTex) click the Edit or View button.

  The file texture opens in the image editor or viewing editor as defined by the Applications preferences. For more information on preferences, see "Application preferences" in the *Basics* guide.
- In Hypershade, right-click the file texture swatch and from the marking menu, select Edit Texture.

  The file texture opens in the image editor as defined by the Applications preferences. For more information on preferences, see "Application preferences" in the *Basics* guide.

Sketch out guidelines ("lipstick") for paint application

You can use Maya's 3D Paint Tool to initially sketch out ("lipstick") where paint should be applied to an object. Painters can then paint more strategically in Adobe Photoshop because they can easily see where to apply the paint. This works especially well for models with UVs that don't give you enough information to paint effectively.

Note	You can also start by mapping file textures (rather than using the 3D Paint Tool.

To lipstick a model

1. Roughly paint what you want to see (for example, eyes, mouth, beard) on the model with Maya's 3D paint Tool. See "What is the 3D Paint Tool?" in the *Paint Effects and 3D Paint Tool* guide.
2. Save the scene.
3. Follow the steps to create and use a PSD File texture. See "Create a PSD file with layer sets from within Maya" on page 90.

   The painted textures are inserted as the base layer in each layer set.

Note	Once you have created the PSD, you cannot go back to 3D Paint for those attributes.

Edit PSD Networks

Once you've created a PSD Network, you can edit it. When you edit a PSD Network you can add or remove attributes in the Edit PSD Network Options window.

To edit a PSD network

1. Do one of the following
   - Select an object or surface in the scene view that has a PSD network created for its material.
   - Select a material swatch in the Hypershade that has a PSD network.
2. Select Edit >Edit PSD Network from the Hypershade menu.

   The Edit PSD Network Options window appears.
3. Add or remove channels as necessary.
4. Do one of the following:
   - If you're finished all the PSD network editing you want to do, click Edit.

     Your changes are saved, and the Edit PSD Network Options window closes.
   - If you want to continue editing another PSD network, click Apply.

     Your changes are saved, but the Edit PSD Network Options window remains open so that you can select another object, surface, or material to edit. When you're finished, and you've applied all your changes, click Close.

Convert a PSD node to a file texture

You can automatically convert a PSD node to a file texture in Maya. You can easily replace large PSD files in your shading network with smaller file textures, once you've finished painting.

To convert a PSD node to a file texture

1 In Hypershade, select the PSD node (in our example, PSD_anisotropic1) in the Work Area.



2 Select Edit > Convert PSD to File Texture from the Hypershade menu.

A file texture node is automatically created. The new file texture node replaces the PSD file in the network, and the previous connections are maintained.



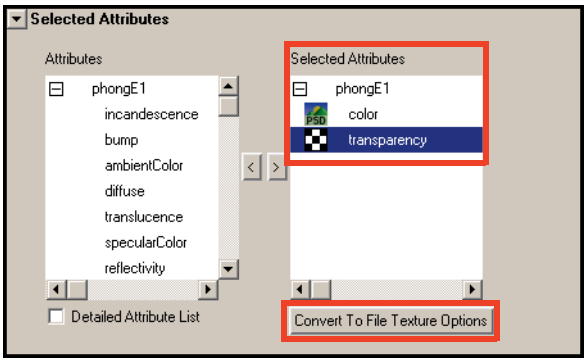
Adjust conversion options

You can include procedural textures in your PSD file, and they are automatically converted to file textures in Maya. These new file textures include specific options you can adjust with the new *Convert to File Texture Options* button in the Create/Edit PSD Network Options window. For more information, see ”Texturing > Create PSD Network” on page 271.

To adjust conversion options

1 Select one or more attributes that are mapped to procedural textures from the Selected Attributes list (Create/Edit PSD Network Options window, Selected Attributes section).

An icon corresponding to the type of 2D or 3D texture indicates the procedural texture.



2 Click the Convert to File Texture Options button.

The PSD Convert Solid Options dialog box appears.

3 Do one of the following:

- If you selected just one attribute to adjust conversion options, proceed to the next step.
- If you selected more than one attribute to adjust conversion options, select one of them from the Connected Attributes list.

4 Adjust the options as required.

These options are a subset of the options available when you convert to a file texture with the Maya Software renderer. For information on the options, see “Edit > Convert to File Texture”.

5 Do one of the following:

- If you selected just one attribute to adjust conversion options, click Apply or Close.

  The PSD Convert Solid Options dialog box closes.
- If you selected more than one attribute to adjust conversion options, click Apply. You can now repeat steps 3-5 for any other attributes in the Connected Attributes list. When you’re finished, click Close.

Update PSD Networks

When you modify a PSD file (in Adobe Photoshop) that is connected to a Maya PSD node (in Maya), you can update (refresh) the image in Maya to show the modifications immediately.

To update a PSD texture in Maya

Select Texturing > Update PSD Networks. All PSD textures in the scene are updated.

File Attributes

Most of the File Attributes are the same as Maya's File Texture Node; see "File" on page 370 for details.

Disable File Load

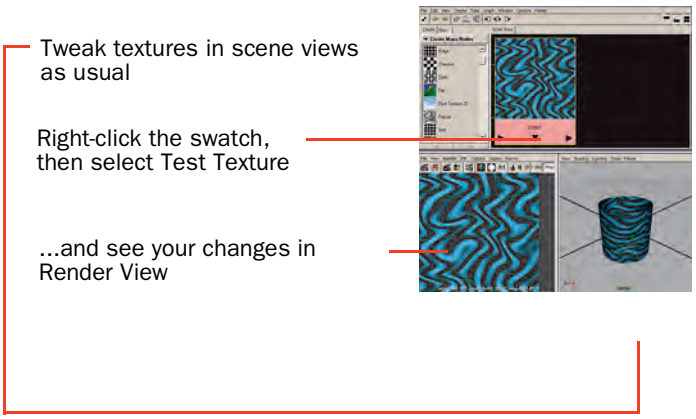
For more information, see "Disable the initial load of a file texture image" on page 97.

Use Image Sequence

See "Use Image Sequence" on page 457.

Test textures

Test textures (and texture ranges)



Available on Windows and Mac OS X.

Though most swatches in Hypershade and the Attribute Editor update automatically to show your changes as you build shading networks, you can now create a full image (or range of images), at various resolutions, on any node in a shading network.

You can use this sample image to see the results of portions of a shading network texture or to verify the look of a texture that doesn't have a visual interactive representation (such as Multiply Divide or Gamma Correct utilities).

You can also perform simple compositing within Maya by connecting several File node outputs to a layered texture and setting the desired attributes. For example, you can composite hardware rendered particles over software rendered scenes.

Limitations and conditions

- Utility node's output must be connected to something downstream to see a sample from it.
- Texture testing supports the native Maya rendering nodes.
- The tested texture always overwrites the same image using the same file name (but you can save it to a different name) from Render View.

To test a texture on any native Maya rendering node

1. In Hypershade, do one of the following:
   - Right-click a render node, then select Test Texture.
   - Select the texture, then select Edit > Test Texture.
   - If you want to change the resolution first, select the texture, then select Edit > Test Texture > ❐ to display the options. For descriptions of the options, see "Edit > Test Texture" on page 298.

   A sample image is rendered in Render View.
2. To save the tested image, in Render View, select File > Save As.

To test a range of images on any native Maya render node

- Do one of the following:
  - Select the texture, then select Edit > Render Texture Range.
  - If you want to change the resolution, file format, frame range or padding, select the texture, then select Edit > Render Texture Range > ❐ to display the options. For descriptions of the options, see "Edit > Render Texture Range" on page 298.

  The rendered range of images is automatically loaded and played back in FCheck.

Disable the initial load of a file texture image

To load scenes faster, you can disable the initial loading of file texture images on a per-node basis from disk.

To disable the initial loading of a file texture image

1. Select the file texture.
2. In the File Attributes section of the Attribute Editor, turn on Disable File Load.

Note	Turning on disableFileTexture off after the file has been read does not "unload" the texture.

Disable File Load

Turn this attribute on to prevent the file associated with the File Texture node from loading.

Using hardware shaders

Work with hardware shaders

Technique

Often, shaders have more than one mode; for example, they may have modes to support two different video card models. You can adjust the technique in the Attribute Editor.

Shader parameters and shader mesh data

There are two types of extra attributes on ASHLI or CgFX materials.

- *Shader mesh data* is used to map Maya constructs onto the shader via the video card. There are two types of hardware card registers you can access: colormaps (color0 and color1), and texture co-ordinates (textcoord0, textcoord1, and so on).
- *Extra Attributes* are shader specific and dynamically created in Maya. Many of these properties are maps (file textures), lighting and surface characteristics.

You can enter the following values: tangent, normal, binormal, <colorSet name>, <uvSet name>. The value of colorSet and UVSet is dependent on the names of color sets and UV sets in your scene. You are free to use any UV or CPV set by simply selecting that set name from the menu (right-click on the text field).

In order to use the shader mesh data properly, you must know which of the arrays the shader is expecting what data in.

Work with CgFX shaders

To load the CgFX plug-in

1. Select Window > Settings/Preferences > Plug-in Manager.

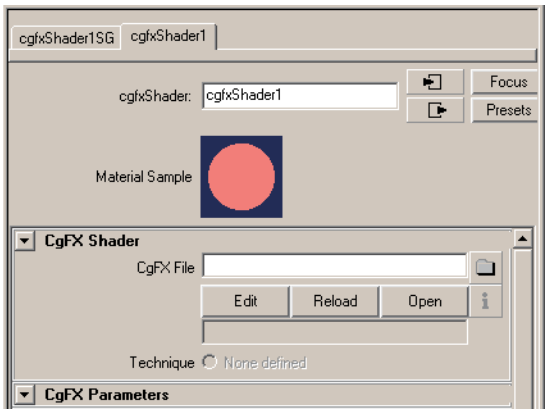
   The Plug-in Manager appears.
2. Load the plug-in.

   For more information on the Plug-in Manager, see “Plug-in Manager” in the *Basics* guide.
3. Click Close.

To create an CgFX Shader material

1. In Hypershade, select the CgFX Shader material from the Create Maya Nodes list.

   The new shading material appears in the Hypershade, and the CgFXShader material node appears in the Attribute Editor.



2. In the Shader section, type in the path to the `.cgfx` file you want to use, or browse to the `.cgfx` file.

   Once the `.cgfx` file is connected to the CgFXShader node, the plug-in automatically loads attributes (if any exist) into the Extra Attributes section in the Attribute Editor.

3. Open the Extra Attributes section, and adjust any attributes as necessary.
4. Assign your new CgFX Shader material to an object in your scene. For more information, see “Assign existing materials to surfaces” in the *Shading* guide.
5. In the scene view, turn on Hardware Texturing (Shading > Hardware Texturing). For more information, see “Shading > Hardware Texturing” in the *Basics* guide.

Adding placement into CgFx shaders

Cgfx shaders do not automatically support texture placement which is found inside Maya (place2DTexture or place3DTexture node) because CgFx is a node which uses a programmable shading language. Using this language means that the texture transform cannot be set from outside. Instead, it needs to be explicitly coded into the shader. If such parameters are in the shader, then the automatic UI generation creates the UI elements. You should then connect the appropriate attributes from the texture placement node(s) to the attributes on the shader.

Reloading, Editing and Viewing CgFX files

See the procedures in ”Reloading, Editing and Viewing FX files” on page 101; the workflows are similar for CgFX editing.

Work with ASHLI shaders

To load the ASHLI plug-in

1. Select Window > Settings/Preferences > Plug-in Manager.

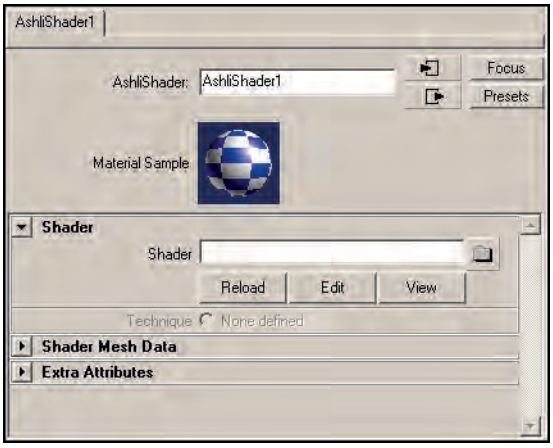
   The Plug-in Manager appears.
2. Load the AshliShader.mll plug-in.

   For more information on the Plug-in Manager, see “Plug-in Manager” in the *Basics* guide.
3. Click Close.

To create an ASHLI Shader material

1. In Hypershade, select the Ashli Shader material from the Create Maya Nodes list.

   The new shading material appears in the Hypershade, and the AshliShader material node appears in the Attribute Editor.

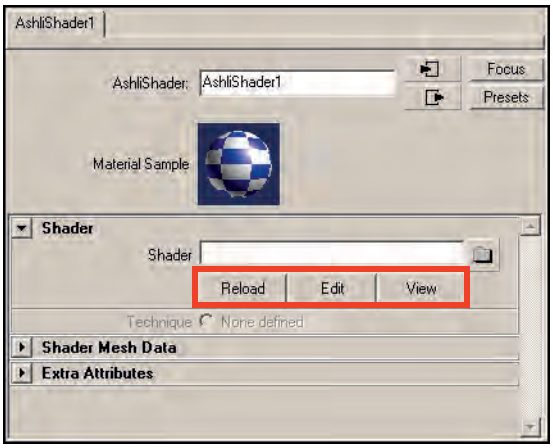


2. In the Shader section, type in the path to the FX file you want to use, or browse to the FX file.

   Once the FX file is connected to the AshliShader node, the plug-in automatically loads attributes (if any exist) into the Extra Attributes section in the Attribute Editor.
3. Open the Extra Attributes section, and adjust any attributes as necessary.
4. Assign your new Ashli Shader material to an object in your scene. For more information, see “Assign existing materials to surfaces” in the *Shading* guide.
5. In the scene view, turn on Hardware Texturing (Shading > Hardware Texturing). For more information, see “Shading > Hardware Texturing” in the *Basics* guide.

Reloading, Editing and Viewing FX files

In the Attribute Editor of the AshliShader node, you can use the Reload, Edit and View buttons to work on the FX file you've specified.



Reload

Reloads the specified FX file from the disk.

Edit

Opens the specified FX file in Microsoft® Notepad on Windows, and `vi` on Linux, for editing. Edit the file as required, and save it. Maya automatically reloads the FX file.

If you want to use a different application for editing, see "Setting viewing and editing preferences" on page 101.

View

Opens the specified FX file in Notepad in read-only format on Windows, and `vi` on Linux.

If you want to use a different application for viewing, see "Setting viewing and editing preferences" on page 101.

Setting viewing and editing preferences

If you want to use an application other than Notepad (on Windows), and VI (on Linux) for viewing or editing FX files, you can set the appropriate Maya option variables in the Script Editor.

For more information on variables, see "Variables" in the *MEL and Expressions* guide. For more information on the Script Editor, see "Script Editor" in the Maya Glossary, available in the Maya Help.

To set viewing preferences

In the Script Editor, enter the following:

```
optionVar -stringValue ashliViewCommandOptionVar
"<application_name>";
```

where <application_name> is the name of the application you want to use for viewing FX files.

To set editing preferences

In the Script Editor, enter the following:

```
optionVar -stringValue ashliEditCommandOptionVar
"<application_name>";
```

where <application_name> is the name of the application you want to use for editing FX files.

Tips for working with ASHLI shaders

GLSL and Maya lights

If you're using GLSL and you want to use Maya lights in your scene, you can take advantage of built-in keywords for the language. Using keywords makes it easier to track numerous lights in your scene.

The usage of keywords is described in *OpenGL® Shading Language* by Randi Rost (Published by Addison Wesley Professional; ISBN:0321197895). You can also see the OpenGL Shading Language specification documents on the 3Dlabs website (developer.3dlabs.com/documents/index.htm).

Rendering the same scene with Maya Software and Maya Hardware

You may have some scenes which you'd like to render in Maya Software and Maya Hardware. For such scenes, you can connect your ASHLI shader to your software shader. This way, you'll have one shader on the mesh for each of the renderers.

To connect an ASHLI shader to a software shader

1. In Hypershade, middle-click and drag the AshliShader swatch onto the software shader swatch that you want to connect it to.

   The Connect Input pop-up menu appears.
2. Select Default.

   The nodes are connected.

Using RenderMonkey FX files

You can use ATI's RenderMonkey™ to develop FX files to use with Maya's ASHLI plug-in. The effects must be saved with the RenderMonkey FX Exporter plug-in in order to be used with Maya's ASHLI plug-in.

Currently the RenderMonkey FX Exporter does not support GLSL, so you can only use HLSL shaders. In addition, RenderMonkey uses an identity world transformation, so some effects may need to be modified to display properly in Maya. To avoid this, change the `ViewProjection` semantic to `WorldViewProjection`.

Display a high dynamic range image

You can load a floating-point image into Maya as a file texture and control its exposure for preview. Supported formats include OpenEXR, TIFF, and DDS. High dynamic range images can now be displayed in the viewport, in the material swatch, or in the rendered image. For display preview purposes, floating point images are reduced to fixed point precision.

During final rendering (including hardware shaders), the original image is used with its full dynamic range.

To use this feature, you must use a plug-in that loads high dynamic range images into Maya and convert them to fixed-point. The following sample API plug-ins have been provided with Maya:

- `OpenEXR.mll` - reads `.exr` images. OpenEXR is a high dynamic range (HDR) file format developed by Industrial Light and Magic ®
- `ddsFloatReader.mll` - reads either half (16-bit) or IEEE 32-bit floating point `.dds` images
- `tiffFloatReader.mll` - reads IEEE-32bit floating point `.tif` images

For all of `.tif`, `.dds`, and `.exr`, only individual 2D images are supported. That is, concatenated or multiple embedded images, (including cube maps, and 3d textures) are not supported. This is equivalent to the support specification for existing IMF based plug-ins. In addition, compression is not supported in the plug-ins as all of `.tif`, `.dds`, and `.exr` do not support floating point compression at this time.

To display an OpenEXR image and control its exposure:

1. Load the plug-in for the desired format using the Plug-in Manager (Window > Settings/Preferences > Plug-in Manager), for example, `OpenEXR.mll`.
2. In the file texture node, expand the High Dynamic Range Image Preview Options section. Select the desired conversion via the Float to Fixed Point attribute. There are three types of conversion available:

   - Clamp

   All color values in your image that are outside the range of 0 and 1 are clamped. Values higher than 1 are clamped to 1 and values lower than 0 are clamped to 0.

- Linear

Normalize the color values in your image to be between 0 and 1.

- Exponential

Retain the lowest and highest color values and ensure that the remaining color values have a reasonable contrast.

3 Adjust the exposure level via the slider bar as desired (only applicable if Exponential is selected as the conversion method).

How Do I? Maya materials and textures

Troubleshoot movies don't play on Image Plane

Not all movie file formats are readable in Maya's image planes.

On Windows, only .avi files are accepted.

Troubleshoot NURBS surface blend renders incorrectly

At times, the result of NURBS surface blend will appear not to render smoothly with the original surfaces.

Running *stitchAndExplodeShell* on the prompt line, with the surfaces in question selected, may correct this situation.

Troubleshoot warped textures

A 2D texture is positioned directly onto a NURBS surface's UV space. If it the texture appears warped the first time you apply the texture, you may need to edit the surface direction, fix uneven UV values (fix texture warp), or even rebuild the surface. See "Texture Map" on page 379 in the Rendering guide.

Note	Convert to File Texture does not support Fix Texture Warp If the surface uses Fix Texture Warp, it is ignored when converting the material.

Troubleshoot can't see the place2DTexture swatch

If you cannot see the place2dTexture swatch, do one of the following:

- Select the texture swatch, then click the Input Connections button on the Hypershade toolbar.
- If no place2DTexture swatch exists, it has been deleted or not created (because it's automatic creation has been turned off by default). You must add one (see "Create a node" on page 53), then connect it to the texture (see "Connect render nodes using their default connections" on page 61) before you can reposition it.

Troubleshoot animated objects swim through 3D texture

Converting a solid texture to a file texture can prevent an animated object from swimming through a 3D texture. For more information, see "Baking illumination and color" on page 147. See also "Troubleshoot textures on deforming surfaces" on page 105.

Troubleshoot when I move a referenced object, the texture swims

This workflow allows you to move the referenced object anywhere in the scene without having the texture swim on the original object.

If the 3D texture node is grouped within an object's hierarchy

1. Select the top node of your object's hierarchy.
2. Create the referenced object. See "Create Texture Reference Object" on page 80.
3. Run the Optimize Scene Size tool.
4. Move the original 3D texture node from the original object's hierarchy into the referenced object's hierarchy.

Troubleshoot movies files are slow to load

The first time you access a frame from an MPEG file, it may be slow to load. The movie library has to scan to the end of an MPEG file to see how many frames are in it since this information is not available in the movie header.

Troubleshoot textures on deforming surfaces

If a procedural texture is very noisy and appears to shift, try increasing the Filter and, or Filter Offset values to try to achieve a slightly blurred effect and to reduce the sharpness that causes the swimming. You can also try increasing the Shading Samples as a last resort.

If a texture does not stick to a deforming surface, you have a few options, each of which have advantages and disadvantages. Check the following table to find out which option is best for your particular circumstance.

Option	Advantage	Disadvantage
Turn on "local" on the 3d texture or projection.	Simple, fast, uses minimal memory, and works for multiple objects. For example, the texture would move correctly with each of many asteroids even if the asteroids are moving in different directions. You don't need to group with objects. The texture can also be animated.	You cannot customize the placement for different objects. Complex object hierarchies appear seamless only if you do a zero transform on the object first. It does, however, move with transforms on sub objects, such as the arms of a robot. The placement node does not reflect the actual position of the texture, which additionally is transformed to the position of each object (at render time). This method does not handle morphing surfaces.
Convert to file texture	Handles morphing surfaces (CV animation) well. Renders as file textures, which can be faster and supports blurring. Can be exported to game engines, and complex texture networks can be collapsed to a single more optimal file texture. Handles multiple objects with different transforms and instances.	Can be too blurry unless the generated resolution is high. For complex objects, this method can generate many textures that use switch nodes. This is a more complicated workflow and can consume a lot of memory; it takes time to do the convert operation. Any animation on the 3D textures is ignored.

Option	Advantage	Disadvantage
Create a reference object	Handles morphing surfaces (CV animation) well. Shows animation on texture and does not blur (unlike converting to file texture). For simple objects memory usage may be substantially less than converting to file texture.	Can be complex to setup and manage, and it may affect render times and memory, particularly for large complex objects.

Troubleshoot Normal Mapping

The following section details troubleshooting topics for normal mapping in the Transfer Map tool. For more information, see "Transfer Maps" on page 40.

Map does not appear in the scene view

Cause

You enable the Transfer Map tool's Connect maps to: New shader / Connect maps to: Assigned shader option and your video card does not support the High Quality Rendering shading mode.

Normal mapping results are only visible in the scene view when in High Quality Rendering shading mode.

Solution

Use mental ray rendering or a plug-in hardware shader to preview the normal map.

Details of normal map are missing or out of place

Cause

Your source surface has non-zero transformations and you transferred your normal map in Object Space.

Solution

If your source and target objects overlap in the scene view, set the Transfer In option to World Space and then bake your map again.

If your source and target objects do not overlap in the scene view and the Transfer In Object Space option produces no result, then move your source and target objects so that they are on top of each other, freeze their transforms (Modify > Freeze Transformations), move them back to their original positions, and then bake your map again.

Map is corrupted or regions of the map are missing

Cause

Your source or target object has overlapping UVs.

Solution

Ensure that your source and target objects have clean, non-overlapping UVs and make sure that their UVs lie within the 0 to 1 UV range.

Sections of my map are missing detail or is blurry

Cause

Your map resolution and sampling quality may be too low or the affected region of your map may not occupy enough UV space.

Solution

In the Transfer Map tool Output settings, do the following:

- Increase the map's resolution. The Map Width and Map Height values determine your map's resolution.
- Increase the map's Sampling Quality.
- Increase the map's Filter Size.
- In the UV Editor, increase the UV mapping coverage for the affected regions of the map.

Map appears pixelated or aliased

Cause

Your map resolution and sampling quality may be too low or the filter size may be too small.

Solution

In Transfer Map tool Output settings, do the following:

- Increase the map's resolution. The Map Width and Map Height values determine your map's resolution.
- Increase the map's Sampling Quality.
- Increase the map's Filter Size.

Sections of my map are missing

Cause

The regions of your map that are absent lie beyond the maximum Search Depth or are excluded by the Search Envelope.

Solution

In the Transfer Map tool Output settings, increase the Maximum Search Depth or change the Search Method.

Source surface detail appears on the wrong side of my target surface

Cause

When the Search Depth for your map is too high, then surface detail from one side of the source object is projected to the opposite or wrong side of the map.

Solution

In the Transfer Map tool Output settings, reduce the Max Search Depth.

Maya runs out of memory when baking the map

Causes

- You do not have enough RAM.
- Maya has insufficient memory to complete the bake operation for your large models and maps.

Solutions

- Bake only one output at a time.
- Only load source and target meshes into your scene.
- For high resolution objects, display them in wireframe shading mode.

Map missing surface details when source has multiple layers

Cause

Your Search Envelope may not include all the source meshes' surface detail or your Max Search Depth may be too low to include all the layers of the source geometry.

Solution

Increase the Search Envelope and Max Search Depth so that they include the missing detail.

Troubleshoot seam appears along UV borders when creating Transfer Maps

Cause

Not enough space between UV shells.

Solution

Ensure that there are at least a few pixels in between all UV shells, and between each UV shell and the edge of the texture. This problem is most likely to occur when creating normal maps.

2 Surface Relief

About

About surface relief

Surface relief is the depressions (low relief) and elevations (high relief) in the surface of an object. Examples include the peaks, valleys, and plateaus of a planet, or a dimples of a golf ball.

Although you could model surface relief into an object's geometry, usually it is faster and easier to achieve the same look with textures used as bump maps (which create the illusion of relief) or displacement maps (which create true surface relief by changing the topology of the object).



Image by
Christine Beaumont

Related topics

- ❖ "Bump maps" on page 112
- ❖ "Displacement maps" on page 113

Scattering

Subsurface scattering refers to light penetrating an outer surface and then being scattered diffusely beneath. This creates the look of a soft surface, often with a very subtle glow. An example of subsurface scattering is human skin, where the soft, porous quality and semi-translucent glow are essential to achieving a realistic look. Other surfaces that require scattering are leaves, wax and gel.

Scatter attributes are available in the Anisotropic, Blinn, Lambert, OceanShader, Phong and PhongE surface material nodes in the mental ray section. By tuning these attributes, you can blur the diffuse component of that particular shader creating the look of subsurface scattering.

These attributes are for use with the mental ray for Maya renderer only.

Using Scattering on Maya materials is an easier alternative to using the native mental images' Subsurface Scattering shaders. For more information, see the *mental ray for Maya Shaders guide*.

Limitations

- Currently, scattering is not supported for instances or shading groups.

- Scattering is not supported for non-continuous surfaces, like adjacent NURBS surfaces. Each surface can have scattering, but they are considered distinct.

Related Topics

- ❖ "Work with Scattering" on page 119
- ❖ "Shared surface material sections" on page 339

Bump maps



Image by Matt Dougan

Bump maps are grayscale textures you map to objects to create the illusion of surface relief (elevations and depressions) on an otherwise flat object.

With bumps maps depressions and elevations look real, but are not, because they don't alter the geometry of the surface the way Displacement maps do. Bump maps just change the direction of the surface's normals based on the bump map's Alpha Gain value.

Use bump maps to create very shallow reliefs. For example, you can make objects look like they are embossed, have shallow rolling hills, and so on.

Because bump maps are not true surface relief, they:

- cannot cast or receive shadows
- cannot be seen if you silhouette the mapped object
- take less time to render than displacement maps

Note	File textures that are used for bump mapping are usually connected via their outAlpha attribute. If the corresponding texture image file does not provide an alpha channel, then the bump effect may be missing when using certain image formats. To avoid this, turn on the Alpha is Luminance attribute in the Color Balance section of the File Texture node. For more information, see "File" on page 370.

Related topics

- ❖ "About surface relief" on page 111
- ❖ "Texture mapping" on page 34
- ❖ "Map a 2D or 3D texture" on page 74

Tips

- Map surface relief (bumps or displacements) to the Blinn surface material to reduce highlight roping or flickering. The soft highlights on Blinn surfaces are less likely to cause roping or flickering than the harder highlights on Phong surfaces.
- Although scratches are like little depressions, you can more easily achieve them with 2D texture.

Displacement maps

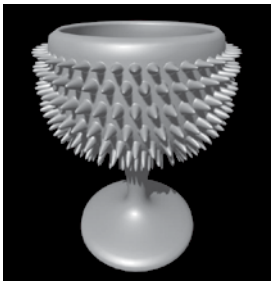


Image by
Christine Beaumont

Displacement maps are grayscale textures you map to objects to create true surface relief (elevations and depressions) on an otherwise flat object.

With Displacement maps, depressions and elevations become part of the geometry of the object, changing the topology, unlike Bump maps that only create the illusion of surface relief.

Notes

- Because displacement changes the geometry of an object, displacement mapped objects usually require further tessellation (more triangles, which the renderer uses to approximate the smoothness of the surface).
  By default, Maya uses Feature-based displacement mapping to automatically add more triangles where required.
- File textures that are used for displacement mapping are usually connected via their outAlpha attribute. If the corresponding texture image file does not provide an alpha channel, then the displacement effect may be missing when using certain image formats.
  To avoid this, turn on the Alpha is Luminance attribute in the Color Balance section of the File Texture node. For more information, see "File" on page 370.

Displacement maps move an object's vertices. By default, the height of the displacement is determined by the Alpha Gain value in the displacement map's Attribute Editor. If you turn on Alpha is Luminance, the height result is based on the intensity of the pixels instead.

Use displacement maps to create shallow or deep surface relief. For example, you can create embossing, mountain peaks and valleys, spikes, and so on.

Because Displacement maps create true surface relief, they:

- can cast or receive shadows
- can be seen if you silhouette the object
- take more time to render than bump maps, which create the illusion of surface relief

Displacement Bounding Box

Because displacement mapping changes the volume of an object, it's bounding box may become too small or too large.

Bounding boxes, which represent the bounding volume of an object, can be used to speed up Maya operations and can make a significant difference for complex models. See "Change bounding box scale" on page 118.

Related topics

- "About surface relief" on page 111
- "Texture mapping" on page 34
- "Map a 2D or 3D texture" on page 74
- "mental ray for Maya displacement" on page 157

Feature-based displacement

By default, Maya uses feature-based displacement mapping to attain high quality displacement mapping with the lowest impact on rendering resources. Displacement *features* are parts of the texture used as the displacement map that provide the information for the height variations (depressions or elevations).

This technique detects the density of the features in the displacement texture (that is, the more detailed areas) and adds triangles to the tessellation only where needed, keeping the triangle count to a minimum.

When using this technique, the tessellation attributes do not have to be set high, just high enough to capture the surface shape.

Non-feature based displacement

Note	We do not recommend that you turn off Feature-based displacement to use non-feature-based displacement.

With non-feature-based displacement the software renderer does not add vertices to the geometry being displaced. As a result, many of the features in the displacement map may be lost if there are not enough vertices in the model.

Maya tries to alleviate the potential loss by bump mapping (in addition to displacement mapping) the displacement map to perturb the normals to create the features where there are not enough vertices. In this case, the bump map's Filter Size and Filter Offset attributes (if they have them) are automatically adjusted for optimal results.

If the material cannot be bump mapped (for example, Layered Shaders cannot be bump mapped), the texture is instead connected as a displacement texture and no bump mapping occurs. You should connect this texture as a bump map where it makes sense. For example, use the displacement texture as a bump map on the various materials connected to the Layered Shader. Attach the bump node to all Normal Camera attributes in the shading network you have just displacement mapped. Also, if you drag a texture onto a displacement node manually within Hypershade instead of dragging from Hypershade onto the Displacement Material area in the Attribute Editor, no bump map is connected, and the displacement may not look right.

How Do I? Connect a texture as a displacement map

For more information about displacement, see "Displacement maps" on page 113.

Notes

- Avoid using Environment textures for displacement mapping. The basic characteristics of environment mapping preclude accurate calculations when used for displacement mapping.
- During bump or displacement mapping, if an image file contains a mask channel, the mask channel is used for displacement and bump mapping. If the mask channel is absent, the luminance of the RGB is used to displace and, or bump map.

If you prefer to use the luminance information as the alpha, turn on the Alpha Is Luminance attribute (in the Color Balance section of the file texture's Attribute Editor).

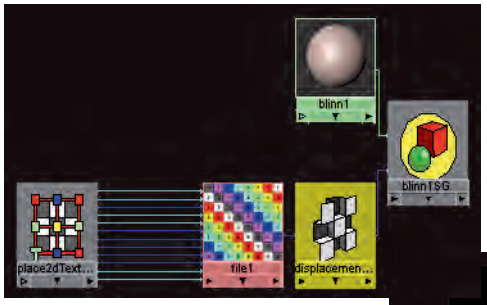
To create a displacement map

1. Create a material in the Hypershade and middle-drag the material swatch onto the object in the view.
2. Select the material swatch in the Hypershade and click the Input and Output Connections button to display its shading group swatch.
3. Double-click the shading group swatch to open the Attribute Editor.
4. Click the box beside Displacement mat. to open the displacement shader's Attribute Editor and click the box next to Displacement to map a texture.

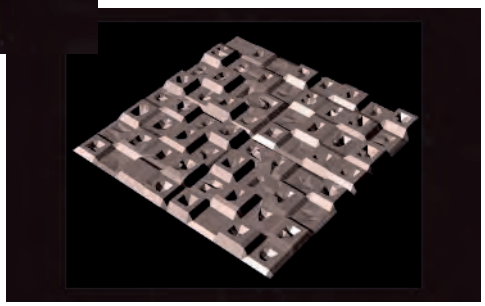
Tip

Displacement mapped texture results do not display in hardware texturing mode (the view) unless temporarily mapped to a material's channel.

You can also use Modify > Convert > Displacement to Polygons.



Hypershade View



Result in Render View

Connect a displacement map

Because displacement maps alter the geometry of the surface, the textures you use as the map should not contain jagged edges (aliasing) or noise.

To filter out aliasing and noise before you displacement map a surface, see ”Texture filtering” on page 34.

If you must use a texture with a small amount of noise for displacement mapping, use Feature-based Displacement mapping, and adjust the Texture Threshold attribute.

Tip	Occasionally when you map a texture with distinct features to an object, the volume, or size, of the object could change. To adjust this problem and preserve the object’s volume (size), use a negative Alpha Offset value for the texture to bring the size of the geometry back down (such as -2). You may also have to adjust the file texture to get the desired result.

Preview the displacement results

To preview the displacement map

Map the displacement texture temporarily to a material’s channel, such as Color, which displays the results in the view (with Hardware Texturing turned on).

Adjust displacement sampling rates

To determine how to set the Initial and Extra sample rates

1. Make sure the displacement mapped object is selected and its Attribute Editor appears.
2. Display the tessellation triangles of the object.
3. "Preview the displacement results" on page 117.
4. For each tessellation triangle, look at how much texture height variation is in the triangle, then (in the Displacement section of the object's Attribute Editor), adjust the Initial Sample Rate.
5. For each tessellation triangle, notice how sharp the features are and how many curvy features there are. The sharper the features, the higher the Extra Sample Rate needs to be; adjust accordingly.

Convert a displacement to polygons

To convert a displacement to polygons

If the displacement isn't changing over the course of an animation, convert the displacement to a polygon mesh to speed up rendering time.

For any surface, after estimating the sampling rates, use the Create Texture Reference Object tool to create a mesh (see "Create Texture Reference Object" on page 80 in the *Shading* guide for more details). This mesh is made from the displaced tessellation.

If not enough texture details are included, try increasing the Initial Sample Rate.

If the mesh is too jagged, try increasing both the Initial Sample Rate and Extra Sample Rate. You should always set the Extra Sample Rate *lower* than the Initial Sample rate.

Change bounding box scale

Warning Be careful if you have an animation that changes the relationship between the displacement and the size of the surface being displaced. Choose the most extremely-displaced frame to perform the Calculate Bounding Box Scale operation. Alternatively, animate the value manually.

To change the bounding box scale

1. In the Memory and Performance Options section of the Render Settings window, turn on Use Displacement Bounding Box (it is on by default).

2 Estimate how much the surface will grow when it is displacement-mapped. Consider the following:

- If the bounding box of the displaced surface will be more than 50 percent larger than the bounding box for the original surface in World Space, open the surface's Attribute Editor and enlarge the bounding box scale.
- If the bounding box of the displaced surface will be less than 50 percent larger than the bounding box for the original surface in World Space, open the surface's Attribute Editor and reduce the bounding box scale to optimize the rendering speed and memory.
- If you choose to let Maya automatically compute the proper bounding box scale for the displaced object, click Calculate Bounding Box Scale in the Attribute Editor and Maya automatically sets the bounding box scale for the surface.

3 Render.

If the estimated bounding box scale is too small, a warning message appears in the render log with instructions on how to set the bounding box scale correctly. An example message:

```
Warning: The bounding box is too small for shape
"surbsSphereShape1". Reset the bounding box scale to: 1.56778
1.56778 1.56778. You can use the following mel commands:
setAttr nurbsSphereShape1.boundingBoxScale -type double3
1.56778 1.56778 1.56778;
```

4 Adjust the bounding box scale as recommended in the render log message.

5 Render again.

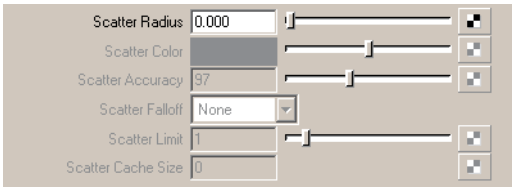
Work with Scattering

To create scattering

Notes	• Scattering is only available on the Anisotropic, Blinn, Lambert, OceanShader, Phong and PhongE shading materials. • Scattering can only be rendered with the mental ray for Maya renderer.

1 Open the Attribute Editor for the shader you want to apply scattering to.

2 In the Attribute Editor, in the mental ray section, turn on scattering by setting a non-zero Scatter Radius.



3 Adjust other scatter attributes as necessary. See ”Shared surface material sections” on page 339 for descriptions of the attributes.

4 Render with the mental ray for Maya renderer.

Tip Scattering may be improved by adjusting the Ray Depth Limit in the Attribute Editor for the LightShape node. Try a Ray Depth Limit value of 2. For more information, see ”Shadow attributes” on page 147, in the *Lighting* guide.

Limitations

- Currently, scattering is not supported for instances or shading groups.
- Scattering is not supported across non-continuous surfaces, like adjacent NURBS surfaces. Each surface can have scattering, but they are considered distinct.

Related Topics

- ”Scattering” on page 111
- ”Shared surface material sections” on page 339

How Do I? Troubleshoot displacement textures ‘pop’

To prevent a displacement texture “popping,” make sure the surface’s Use Min Screen attribute is turned off in the Secondary Tessellation Attributes section of its Attribute Editor.

Use Min Screen tessellates a surface based on its distance from the camera and uses the screen space to determine how much tessellation is required (as opposed to object or world space). If the surface is moving toward or away from the camera and Use Min Screen is on, the tessellation changes over time, and the displaced texture pops.

Troubleshoot black holes appear on rendered surfaces with displacement maps

You can do either of the following to correct this problem:

1. The bounding box scale is not large enough. Click on the Calculate Bounding Box Scale button (under the Displacement Map section in the shape node's Attribute Editor) and Maya automatically computes the correct bounding box scale for the displaced object.
2. Use mental ray to render the scene.

Troubleshoot my blurred file texture looks crisp, not blurred

Maya's file texture node provides controls for blurring the texture (filter size and filter offset), but these controls behave differently when the texture is applied to a color channel versus a displacement map, so that extremely fine details can be captured.

So, though you can bring (for example) a photograph into Maya, use the filter size/offset controls to blur it out, and map it to the color of an object to see blurry texture on your object when you render, you won't get the same result if you apply that blurred texture as a displacement map. Instead, the embossed image looks very crisp.

You have two options to blur the image suitably for displacement mapping:

- Increase the filter values, possibly into the hundreds before you begin to see blurring of the displacement map
- Make use of the Pre Filter control to blur the image file before it is used for rendering. This applies an image-space filter of a specified radius (in pixels) to the image before any operations are done on it.

3 Backgrounds

About

About backgrounds

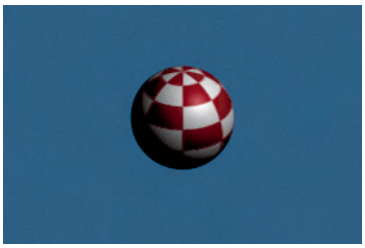
Typically you render the objects in a scene against a black background and composite the rendered images later with an appropriate background using compositing software. However, you can insert a background:

- to avoid having to model background objects or scenery, but want them represented, 2Dly, in your scene (especially if you don't have access to compositing software).
- as a temporary reference (especially for rotoscoping or motion matching) for modeling or animating objects in the scene.

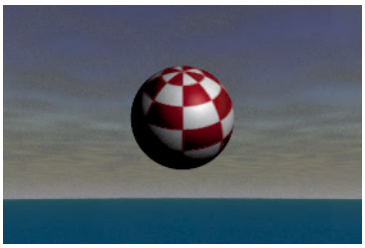
To create a background, see "Create a basic color background" on page 126.

Note	When you create a background in Maya, you create it for a specific camera. When you render a scene from that camera, the background is included in the rendered image. If you render the scene from a different camera, the background is not included. For more information on cameras, see "Maya camera types" on page 25 in the *Lighting* guide.

Basic color and texture backgrounds



Color backgrounds flood the background with a solid color.



Texture backgrounds use a 2D, 3D or Environment texture to simulate a 3D environment.

Color backgrounds

A color background floods the background of the scene with a solid color (for example, black, white, or red). To create a color background, see "Create a basic color background" on page 126.

Texture backgrounds

A texture background uses a 2D, 3D, or environment texture on an image plane to simulate a 3D background, or *environment*.

To create a texture background, see "Create a texture background" on page 127.

Image file backgrounds

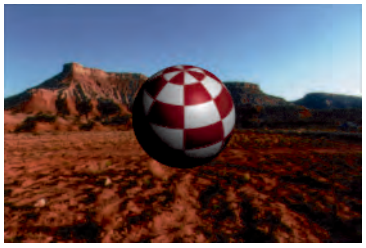


Image file background use an image file, a series of image files, or a movie file as a background.

You can import an image, a series of image files, or a movie file and map them to an image plane to act as a backdrop for your scene. You can use this backdrop in the following ways:

- As a reference while you build your scene.
- As the background for your scene instead of you having to build it all.
- To catch shadows and reflections with the Use Background material (see "Shadow catching" on page 25 in the *Lighting* guide.
- To produce environments with Environment textures.

Image planes are automatically created at the camera's far clipping plane. They are perpendicular to the camera and parented to it so that even when a camera moves or changes the point of interest, the image plane still covers the entire view behind your scene.

You can create multiple image planes per camera for interesting backgrounds, ordered by depth. To create, edit, or position an image plane, see "Create, edit, or position an image plane" on page 127.

The Image Plane Attributes control the appearance and placement of an image plane. For a detailed description of image plane attributes and guidelines on how to change them, see "Image plane" on page 454.

Image plane syntax

When you import an image as an image plane, the syntax must be as follows:

- name.# (or name.#### for multiple frames)
- name.#.ext (or name.###.ext for multiple frames)

Static image file backgrounds

A static image file background uses a single image file as a background. The background image does not change during an animation.

To create a static image file background, see "Create a static image file background" on page 130.

Animated image file backgrounds

You can create an animated image file background using either a series of image files or a movie file. (A movie file updates in the views much faster than a series of image files.)

To create an animated image file background, see "Create an animated image file background" on page 130.

Note	If a moving camera was used to record the original image files or movie file that you want to use as a background, then you must match the camera's motion using Maya Live. See the *Maya Live* Guide.

3D background simulations

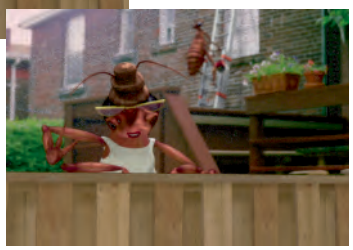
An image file background is a 2D image that exists behind the objects in the scene. You can, however, simulate a 3D background by creating "stand-in" surfaces that represent objects in the background image. An object in the scene can then:

- move behind an object in the background image.
- cast shadows onto objects in the background image.
- receive shadows from objects in the background image.
- be accurately reflected by the objects in the background image.

This background image contains a fence. You want a CG character to appear behind the fence.



You would first create a stand-in surface for the fence, then position the CG character behind the stand-in surface



For more information, see:

- "Create a 3D image file background" on page 131.
- "Create a static image file background" on page 130.
- "Create an animated image file background" on page 130.

Important

Before you create an image file background, you should set up the camera, and the camera's view so that it matches the camera used to record the background image. For more information about setting up cameras, see "Maya camera types" on page 25 in the *Rendering* guide.

Note It is also possible to create a 3D image file background so that the objects in the scene accurately reflect the objects in the background image.

How Do I? Create a basic color background

For more information on basic color backgrounds, see "Basic color and texture backgrounds" on page 123.

To create a color background

In the Environment section of the camera's Attribute Editor (View > Camera Attribute Editor), set the Background Color attribute.

For more information on a camera's Attribute Editor, see "Attribute Editor" on page 330 in the *Basics* guide.

Create a texture background

For more information on texture backgrounds, see "Basic color and texture backgrounds" on page 123.

To create a texture background

1. In the Environment section of the camera's Attribute Editor (View > Camera Attribute Editor), click the Create button to the right of the Image Plane attribute.

   Maya creates an image plane and connects it to the camera.
2. Set the Type attribute for the image plane to Texture.
3. Click the texture button for the Texture attribute.

   The Create Render Node window appears.
4. Select the texture you want to use as a background (for example, an Environment Texture).

   Maya creates the texture and connects it to the image plane.

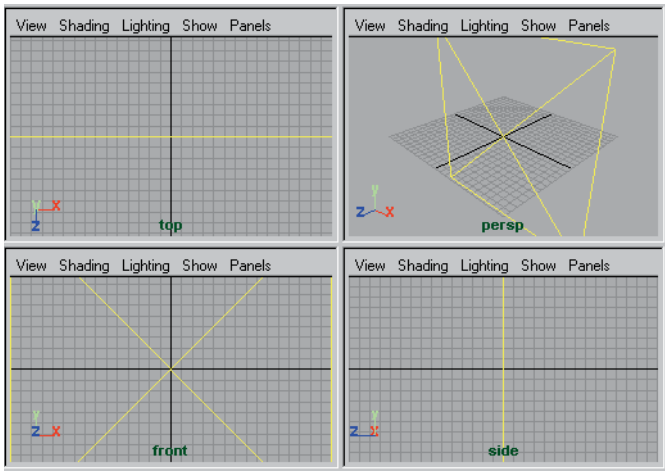
Create, edit, or position an image plane

For more information about image planes, see "Image plane" on page 454.

To create an image plane

1. Select View > Image Plane > Import Image from the current view.
2. Browse to the file you want and click Open.

   A placement icon appears in either the current view or all views, depending on the Display mode you set (in all views by default), and the Image Plane Attribute Editor opens.
3. Select an Image File or Texture from the Type drop-down list, then click the folder icon next to Image Name to load an image plane into the view.



For a description of image plane attributes, see "Image plane" on page 454

To edit an existing image plane

Tip	Right-click the arrow key of the image plane attribute in the camera to display a list of the image planes per camera.

Select View > Image Plane > Image Plane Attributes from the current view and choose any of the camera's image planes you want to edit.

The selected image plane's attributes display in the Attribute Editor (unless the Attribute Editor has been hidden)

To position an image plane

Do one of the following:

- Use the Placement attributes to position an image plane relative to the camera. See "Placement" on page 458.
- Use the Placement Extras attributes to control which portion of an image file is visible on the image plane. See "Placement Extras" on page 463.

Depth compositing with image planes

Maya's image plane now features real-time z-depth compositing in the camera viewport. This z-depth compositing feature allows you to place 3D objects further and closer within the field of view of the camera together with an image plane mapped with depth information. Objects that are closer than depth values in the image will appear in front of it. Objects that are further than depth values in the image will appear behind it.

The z-depth data is contained within the z channel of an `.iff` image file mapped to the image plane.

The z-depth data is used to offset the image plane's pixels relative to its camera. Therefore, the z-depth feature only works for the image plane's respective parent camera. Other cameras will not be able to visualize image plane depth.

By default, z-depth map support is disabled, even if the image file contains z-depth values. To enable Z-depth support, follow these steps.

To enable depth map support of your image plane

1. Select View > Select Camera to select the current camera.
2. In the Camera's shape node, expand the Environment section in the Attribute Editor. Click the Create button to create an image plane.
3. In the image plane Attribute Editor, expand the Depth section.
4. Check the Use Depth Map option to enable z-depth support.

   If z-depth data exists in the specified image file, then it is represented in the viewport; or, the software render has composited z-depth information.

To optimize performance, it is recommended that image resolution be an integral multiplier of the render output resolution (for example, set the image resolution at two times the render output resolution and not two and a half times). Otherwise, the image may need to be resampled to fit in the render area.

Notes

- Currently, you can only use z-depth compositing with `.iff` image files.
- Z-depth compositing is not supported by the mental ray for Maya renderer.
- A camera that has more than one image plane with z-depth data may not render properly in the viewport. However, a camera that has only one image plane with z-depth data will render properly in the viewport even if that camera also contains multiple image planes with no z-depth data. Software rendering is not affected in either case.
- Partially transparent pixels may not render correctly because depth information is usually undefined at their color value.
- When z-depth compositing is enabled, the image plane cannot be rotated.
- Occasionally, when z-depth data is resampled for display in the viewport, you can see rendering artifacts where depth values do not line up with the color information. Software rendering is not affected.

Create a static image file background

For more information on image file backgrounds, see ”Image file backgrounds” on page 124.

To create a static image file background

Do one of the following:

- In the Scene View, click View > Image Plane > Import Image. An image plane is automatically created and connected to the camera and you are prompted to choose the image.
- In the Environment section of the camera’s Attribute Editor (View > Camera Attribute Editor), click the Create button to the right of the Image Plane attribute.

  Maya creates an image plane and connects it to the camera.

Tip	Multiple image planes can be created per camera for interesting backgrounds, ordered by depth. right on the arrow key of the image plane attribute in the camera to display a list of the image planes per camera.

- Make sure that the Type attribute for the image plane is set to Image File (the default setting).
- Click the folder button for the Image Name attribute. The file browser appears.
- Select the image file you want to use as a background, and click Open. Maya connects the image file to the image plane.

Create an animated image file background

For more information on image file backgrounds, see ”Image file backgrounds” on page 124.

To create an animated image file background

1. Create a static image plane. ”Create a static image file background” on page 130.
2. In the image plane’s Attribute Editor, turn on Use Image Sequence.

   This automatically enters an expression (=frame) into the Image Number attribute. The Image Number is equal to the Timeline’s current frame.

   If a non-standard animated image sequence logic is desired, you can either edit the expression on the Image Number attribute (right-click Image Number and select Edit Expression) and enter the desired changes. For example, if you wanted to slow down the image sequence to "playback" at half speed you could add a divide by 2 to the expression.

Alternately, you can remove the expression from the Image Number attribute and set key frames on the Image Number attribute just like animating any other attribute. This allows for complex image sequence logic, for example reversing the image sequence or holding the first frame, then "playing" then holding the last frame.

To add file formats

Find the `getFileSequenceFormats.mel` file in the `Maya8.5\Scripts\Others` folder.

Create a 3D image file background

For more information on image file backgrounds, see ”Image file backgrounds” on page 124.

To create a 3D image file background

1. Create an image file background for the perspective camera you plan to render from (see ”Create a static image file background” on page 130 or ”Create an animated image file background” on page 130).
2. Use the background as a reference to create a relatively simple surface or group of surfaces to act as stand-ins for the objects in the background image that you want to interact with the objects in the scene.

   For example, if you want an object in the scene to cast a shadow onto the floor in the background image, create a plane as a stand-in for the floor.
3. Scale and, or position the stand-in surfaces so that they are directly over the correct areas of the background image.
4. In Hypershade, select Create > Materials > Use Background, and assign the new material to the stand-in surfaces. The stand-in surfaces have the same color as the objects in the background image that they represent.
5. You can now make objects in the scene appear to move behind objects in the background image by moving them behind the stand-in surfaces.

   The objects in the scene also appear to cast shadows onto the objects in the background image by casting shadows onto the stand-in surfaces. Consider the following:

   - To make objects in the background image appear to cast shadows onto objects in the scene, in the Render Stats section of the stand-in surfaces’ Attribute Editor, turn on Cast Shadows.
   - To make the objects in the scene appear to accurately reflect objects in the background image, in the Render Stats section of the stand-in surface’s Attribute Editor, turn on Visible in Reflections. Visible in Reflections is on by default.

To make objects in the scene accurately reflect the objects in the background image

1. Assign a Blinn or Phong material (for example) to the stand-in surfaces. Do not use a Use Background material.
2. Map a File projection texture to Color—select As projection when applying the texture in the Create Render Node window, or if importing a file, select As Projection from "File > Import Selected Image Files" on page 292.
3. Map the background image to the Image attribute, set Proj Type to Perspective, and set Link To Camera to the camera with the background image.

   The stand-in surfaces now have the same color as the objects in the background image they represent *and* the objects in the scene accurately reflect the objects in the background image. However, it also means you have to illuminate the stand-in surfaces properly to make them look identical to the objects in the background image that they represent.

Size and position an image file background

How you position a texture or image file background depends on whether the background's Image Plane attribute is Attached to Camera or Fixed.

When you create a background for a perspective camera, Image Plane is Attached to Camera by default. When you move the camera, the image plane also moves. You use this setting when you are using the image plane as a reference for animating objects in the scene (that is, motion matching or rotoscoping), or if you plan to render the image plane as a background.

When you create a background for an orthographic camera, Image Plane is Fixed by default. When you move the camera, the image plane does not move. You use this setting when you are using the image plane as a reference for modeling objects in the scene.

For more information on image file backgrounds, see "Image file backgrounds" on page 124.

Remove or hide a background

For more information on image file backgrounds, see "Image file backgrounds" on page 124.

To remove a color background

In the Environment section of the camera's Attribute Editor (View > Camera Attribute Editor), set the Background Color to black.

To temporarily turn off a texture or image file background

In the Image Plane Attributes section of the image plane's Attribute Editor (View > Camera Attribute Editor), set Display Mode to None.

To permanently remove a texture or image file background

In Hypershade, select the image plane swatch and either press Delete or select Edit > Delete.

How Do I? Troubleshoot grainy or jagged background image

Do either of the following:

- Render the scene without a background image then composite the rendered image with the background image using compositing software.
- Increase Shading Samples and Max Shading Samples (to the *lowest* values that produce acceptable results) for the image plane.

4 Reflection and Environment

About

True reflections

To create true (photorealistic) reflections, you must raytrace the scene, a process which can take a significant amount of time, depending on the complexity of your scene. To optimize raytracing to reduce rendering times you can limit the number of reflections per surface and which surfaces reflect.

Raytracing is a type of shadow rendering where the path of individual light rays are calculated from their source (the light) to their destination (the camera). For more information on raytracing, see "Depth map and raytraced shadows" on page 23 in the *Lighting* guide.

To create true reflections, see "Create true reflections" on page 136. See also "Create blurry reflections using mental ray for Maya" on page 186.

Simulated reflections

To simulate reflections, which can significantly reduce rendering time, you must use a texture as a reflection map. You apply the map to the Reflected color attribute of the object's material to specify how the reflected environment looks on the object.

For more information on maps, see "Texture mapping" on page 34.

Note	Reflectivity vs. reflected color Reflectivity determines the degree to which a surface reflects its surroundings; reflected color (if raytracing is not used) determines what is reflected.

Environment textures

Environment textures simulate 3D spaces using a series of image files (Env Ball, Env Cube, Env Sphere) or using a computer graphic procedure (Env Chrome and Env Sky).

You can use them to create reflections.

You can simulate reflections using the following environment textures: Env Ball, Env Cube, and Env Sphere. To simulate reflections:

- see "Simulate reflections with Env Ball" on page 137.
- see "Simulate reflections with Env Cube" on page 138.
- see "Simulate reflections with Env Sphere" on page 139.

When used to map image planes, environment textures do not use the reflected direction; they use the camera view direction. This means, for example, that in an Env Sky texture, if you want to see the sun on the background, it must appear in

the view in front of the camera. Use the Env Sky manipulator and rotate or scale it until the line representing the sun is pointing to the background (you can achieve the same result by changing the sun elevation and azimuth). (For more information on image planes, see "Create, edit, or position an image plane" on page 127.)

Note	Do not map an environment texture to a material's Bump or Displacement parameter. The basic characteristics of environment mapping preclude accurate calculations when used for displacement mapping. An environment texture mapped to Bump produces unpredictable results; Maya ignores an environment texture mapped to Displacement. For more information on displacement mapping, see "About surface relief" on page 111.

How Do I? Create true reflections

For more information about true reflections, see "True reflections" on page 135.

Note	To create true (photorealistic) reflections, you must raytrace the scene, a process which can take a significant amount of time. For more information about raytracing, see "Depth map and raytraced shadows" on page 23 in the *Lighting* guide.

You must have at least two surfaces to create true reflections (or a surface that somehow curves around so one part of its surface can reflect onto another part of its surface).

You can control which surfaces appear in reflections and which don't by turning Visible in Reflections on or off in each surface's Attribute Editor. (Visible in Reflections is on by default when you create new surfaces.)

To create true reflections (example)

1. Create a sphere and a plane, and position the sphere over the plane. Create a light to illuminate both surfaces.
2. Create a specular material (a Phong or PhongE) and assign it to the sphere. The sphere is reflected in the plane.
3. Create a second material and assign it to the plane. The plane reflects the sphere.
4. Make each surface a different color so you can see the reflection of one in the other.

5 In the Raytracing Quality section of the Render Settings window, turn on Raytracing.

This tells Maya to raytrace any surface whose Visible in Reflections/ Refractions is toggled on. These attributes are on by default for all surfaces, but raytracing only works when you turn on Raytracing in the Render Settings window.

To learn more about the Render Settings, see "Render Settings window" on page 265 in the *Rendering* guide.

6 Perform a test render to visualize the results. If you want the sphere to reflect the plane, open the plane's Attribute Editor and turn on Render Stats > Visible in Reflections.

To test iterations of a scene, see "Visualize interactively with IPR" on page 115 in the *Rendering* guide.

Simulate reflections with Env Ball

For more information about this texture, see "Env Ball" on page 408.

To use the Env Ball environment texture, you must map the texture's Image attribute with the image of a reflective chrome ball in the environment you want to re-create. You should also create an image plane for the camera and map the image plane's Image Name attribute with the image of the environment without the chrome ball.

To create an image of a chrome ball

1 Place a highly reflective chrome ball (sphere) in the environment (real world or computer generated) that you want to re-create.

2 Place the ball at the exact location (in the original environment) where you want the model to appear (in the re-created environment), and take note of the ball's distance from any floor/walls/ceiling or large objects.

3 Photograph (or render) the ball using a telephoto lens, and take note of the camera's elevation (the angle between the camera's view and the environment's grid plane), and the camera's inclination (the angle between the camera's view and the environment's YZ plane).

The photo essentially contains a compressed sample of the entire environment, except for the area directly behind the ball. The highest resolution is in the direction of the camera, so the image provides the best data compression for that point of view.

To re-create environments using Environment Ball

The Env Ball texture can best re-create environments that have no objects in their center (that is, near the chrome ball). For example, rooms and interiors should not contain furniture, and outdoor scenes should not have trees or cars near the chrome ball. (In general, outdoor scenes can contain buildings.)

To use a single image of a chrome ball using Environment Ball

1. Map a File texture to the Env Ball texture's Image attribute, and then map the image file of the ball in the environment to the File texture's Image attribute.
2. Map the image of the environment without the chrome ball to the image plane's Image attributes.
3. Set the Env Ball texture's Inclination and Elevation attributes to the inclination and elevation of the camera used to photograph the ball.

To obtain accurate reflections for the Environment Ball texture

For accurate reflections of the re-created environment on the model, set the Environment Ball texture's Projection Geometry attributes to values corresponding to the distance between any floor/walls/ceiling or large objects and the chrome sphere when it was photographed.

To position the image planes's image for the Environment Ball texture

To simplify positioning the image plane's Image, set the Env Ball texture's Eye Space on.

To model background geometry when using the Environment Ball texture

To model background geometry (for example, so you can add shadows, lighting effects, or fog to the scene), set the Env Ball texture's Reflect attribute off.

Simulate reflections with Env Cube

For more information about this texture, see "Env Cube" on page 412.

To make reflections using the Env Cube material

1. Create a material, and map an Env Cube to its Reflected Color attribute.
2. Make the Env Cube's texture placement object visible in the scene views and scale, rotate, translate it, or even animate the transformations.

   Reflections of the Env Cube are rendered as if the six images in the texture were mapped directly onto the six faces of the placement box.

Notes

- A hardware rendered environment cube map matches the textured 3D view, but compared the software rendered result, the front and back images will be swapped.

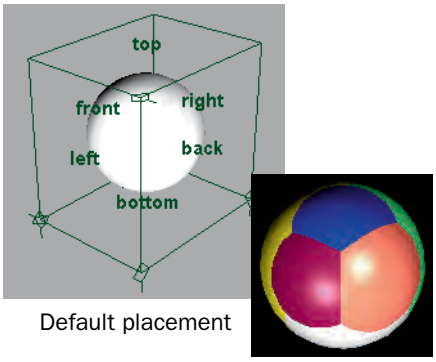
If you want the hardware rendered result to match the software rendered result (which won't match the hardware textured scene view, however), open the Attribute Editor for the cube map and swap the images for the front and back.

- About backward compatibility:

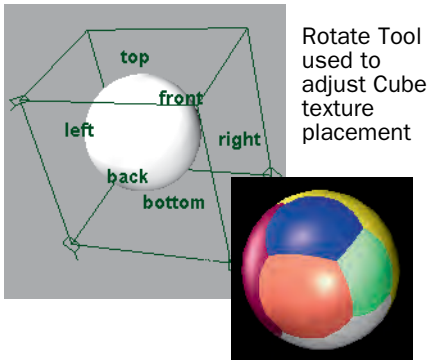
To achieve an infinite cube effect for backwards compatibility, turn on Infinite Cube.

To use the Cube's texture placement object

Use Maya's transform tools with the Cube's texture placement object to adjust the placement of the texture on the object. To see the results, IPR render the surface.



Default placement



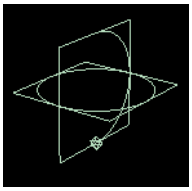
Rotate Tool used to adjust Cube texture placement

Simulate reflections with Env Sphere

For more information about this texture, see "Env Sphere" on page 417.

To use the Sphere's texture placement object

The Sphere environment texture provides a texture placement object to adjust the texture on the surface. Use Maya's transform tools to scale, move, or rotate the texture placement object.



You can also interactively place the texture, or fit it to the object. Select either Interactive Placement, which provides you with a special manipulator, or Fit to group bbox from the Sphere's place3dTexture attributes.

How Do I? Troubleshoot cube maps swap front and back images

A hardware rendered environment cube map matches the textured 3D view, but compared the software rendered result, the front and back images will be swapped.

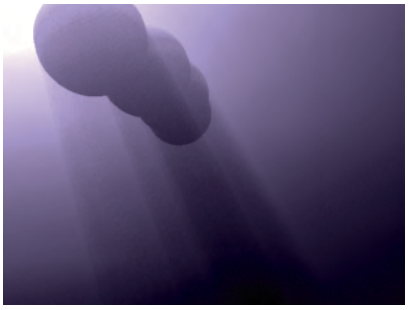
If you want the hardware rendered result to match the software rendered result (which won't match the hardware textured scene view, however), open the Attribute Editor for the cube map and swap the images for the front and back.

5 Atmosphere

About

Fog, smoke, dust, and silt

Maya's volumetric materials and mental ray for Maya's volumetric materials let you simulate fog, smoke, dust, or other atmospheric effects.



mental ray for Maya's participating media.

You can create atmospheric effects such as fog, smoke, dust in the following ways:

- For basic spherical, conical or cubicle effects, create the appropriate Maya volume primitive, then assign a Maya volumetric material to it, then render with Maya software.
- For more complex shapes, create any geometrical object, then assign a Maya volumetric material to it, then render with mental ray for Maya.
- Use mental ray for Maya's participating media. The workflow involves assigning a transfer material to achieve physically accurate light participation, with the potential to generate shadows and caustics.

(Alternatively, you can create the effect in post production (that is, outside Maya).)

How Do I?

Simulate fog, smoke, or dust

To simulate fog, smoke, dust, or other atmospheric effects with Maya software rendering, you create a volumetric primitive (shape) and assign one of Maya's volumetric materials to the shape.

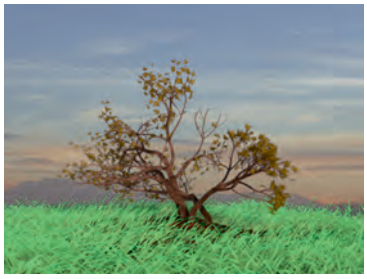
Important

Environment fog cannot cast shadows. If you want to cast shadows, use Light Fog.

To create environment fog

1. In the Render Options section of the Maya Software tab of the Render Settings window, click the map button beside the Environment Fog attribute. Maya automatically creates an environment fog node and an environment fog light node (an ambient light).
2. Choose between Simple Fog or Physical Fog. For more information on each of these fog types, see "Environment Fog" on page 351.
3. Place the environment fog as desired. To position the environment fog interactively, press the hotkey t to display the camera/light manipulators. Alternatively, you can choose Display > Rendering > Camera/Light Manipulator and select among different types of light manipulators.

   For more information regarding manipulators, see "Show, hide, or resize a light manipulator" on page 30.



Sample scene with environment fog

To adjust the depth range for environment fog

To make environment fog fill a specific region (between two distances from the camera), set Distance Clip Planes to Fog Near/Far and adjust the Fog Near Distance and Fog Far Distance attributes.

To adjust the vertical range for environment fog

To make environment fog fill a specific vertical region, turn on Use Height and adjust the Min Height and Max Height attributes. To make the edges of the region gradually blend, adjust the Blend Range attribute.

To create variations in environment fog's density and color

To create variations in the density and color of environment fog across the camera's view, turn on Use Layer and assign a texture to the Layer attribute. (You may need to limit the Depth Range, and increase Volume Samples for the environment fog shape to see the effect.)

Change the visual effect of fog, smoke, or dust

For more information about volumetric materials that let you simulate fog, smoke, and dust, see "About volumetric materials" on page 351.

The Volume Shader lets you connect other attributes and effects directly to its color, transparency, and matte opacity. The Volume Shader can be used with a Spot Light, Point Light, Environment Fog, and particles.

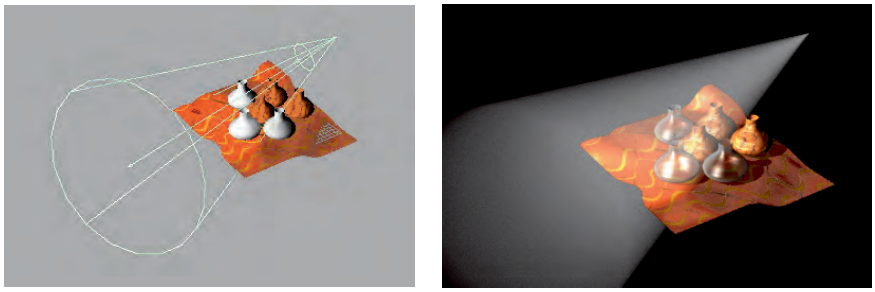
Try this simple example. By mapping a Volume Shader to a Spot Light's Light Fog, you can map textures to the Volume Shader's attributes and change the fog's visual effects.

To use the Volume Shader with Light Fog (example)

Use a spot or point light in the scene. This example uses a spot light.

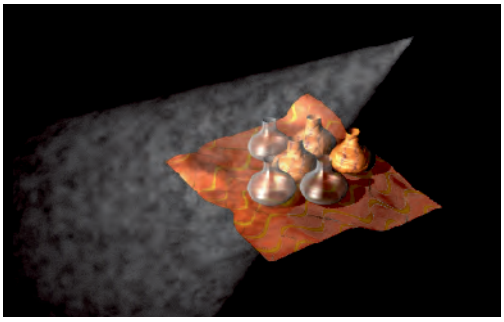
1. In the spot light's Attribute Editor's Light Effects section, click the Light Fog map button to map it to the light.

   The spot light's icon increases in size. If necessary, bump up the Fog Spread and Fog Intensity values.

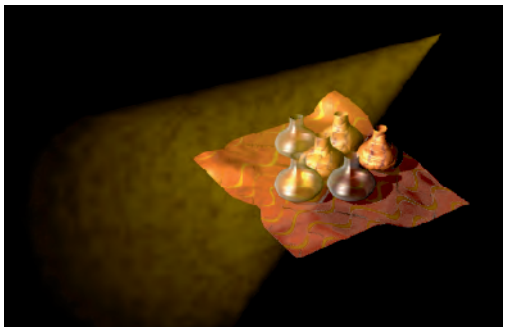


Spot Light with Light Fog in view.

2. In the Hypershade, create a Volume Shader material.
3. Middle-drag the Volume Shader material swatch over the Spot Light swatch and select an attribute, such as color, with which you want to map the Volume Shader.
4. Open the Volume Shader's Attribute Editor and map a texture, such as cloud, to the Out Color attribute. The following shows the rendered result.



Change the Cloud texture's attributes to change the fog effects if necessary.



In the next example, the sphere on the left appears flat (2D) because it is shaded by a Surface Shader. Notice the absence of shadow on this sphere compared to the one on the right. The light fog on the right appears flat because it is shaded by a Volume Shader. Notice the absence of volume shadows compared to the light fog on the left.

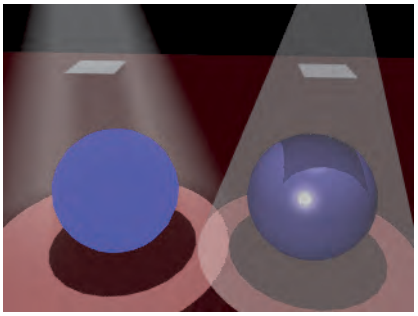


Image by Kelvin Sung

How Do I? Troubleshoot Environment Fog problems

You may notice the following problems in environment fog in a rendered image.

Transparent surfaces look incorrect



Set Ambient Shade to 0 for the environment fog light.

Jagged surface edges in environment fog



Do one of the following:

- Turn on Shading Samples Override for the environment fog shape. Increase Shading Samples and Max Shading Samples (to the *lowest* value that produces acceptable results).
- Increase Edge Anti-aliasing in Render Settings window (to the *lowest* setting that produces acceptable results).

Outlines around 2D motion blurred surfaces



Do one of the following:

- Remove any transparent objects, fog, and, or glow, and set the background color to black. Render the scene, then composite the elements you removed with the rendered image using compositing software.
- In the Render Settings window, set Smooth Value to 0 and turn on Smooth Color.

Grainy or flickering environment fog

Do one of the following:

- Turn on Shading Samples Override for the environment fog shape, and increase Shading Samples and Max Shading Samples (to the lowest value that produces acceptable results).
- Turn on Volume Samples Override for the environment fog shape, and increase Volume Samples (to the *lowest* value that produces acceptable results).

6 Baking textures and Prelighting

About

Baking illumination and color

In a typical scene, you shade, texture, and light objects to create the look you want, then you render. You can instead pre-render materials, textures and illumination in a process called baking (by render experts) or prelighting (by modeling experts).

Baking effectively freezes the illumination (and shadow and surface color, if wanted) of baked objects into an image file (if you bake to textures) or data (if you bake to vertices) that you can later apply to objects.

After you bake objects and apply the prerendered illumination to objects, you can simplify the scene by removing lights, materials, and textures (shading networks). Instead of computing illumination at render time, the renderer instead obtains it quickly from the applied file image or data that is produced (depending on what you bake to – textures or vertices).

When to bake objects

- To accelerate time- and processor-intensive renders, particularly for complex shading networks or if mental ray for Maya's global illumination features are involved.
- To optimize renders for use on simpler display devices (such as a console game rendering engine).
- To achieve lighting effects that would otherwise be difficult to achieve in other ways.
- Export to a platform that does not support certain shading effects. For example, some graphic APIs only support a limited number of lights, and many platforms have a limited amount of texture memory available. If you bake the effects of the lights and textures onto the geometry, the lights and textures can then be removed from the scene.

Note In Maya, baking is called Convert to File texture. See "Convert a texture or shading network to a File Texture" on page 81.

Related topics

- "Bake sets"
- "Baking to textures and vertices" on page 160
- "Baking with final gather" on page 161

Bake sets

Though you can perform a simple bake without bothering with them, bake sets are convenient way for those who require more flexibility to perform complex baking options (such as game developers).

A bake set is a type of set in Maya. Bake sets define parameters for a collection of polygon or NURBS objects. A Maya scene can use multiple bake sets to vary the result of baking. There are two types of bake sets in Maya. Vertex bake sets (see "Vertex Bake Set" on page 245) contain polygon objects, and Texture bake sets (see "Texture Bake Set" on page 245) can contain NURBS or polygon objects. The type of bake set used determines the available parameters.

Bake sets let you:

- Easily apply different settings to different objects and bake them all at once.

  For example, you can texture-bake objects with different UV ranges or output resolution, or vertex-bake objects with different color blending or clamping.
- Group objects to be baked with the same settings, then bake the groups all at the same time.
- Override any number of bake settings and save the overrides as a preset with a meaningful name. This lets you compare and contrast settings, re-baking as needed, without having to manually change individual settings.

Assigning objects to bake sets

By default, any object in your scene is automatically assigned to the initial vertex bake set or the initial texture bake set (depending on what you choose to bake to) as soon as you bake the object. The initial bake set lets you bake objects with the same settings easily without having to set up additional bake sets.

If you want to bake objects with different settings, create bake sets and assign objects to them. An assigned object is baked according to the attributes of the bake set to which it is assigned, whether it is the default initial bake set, a texture bake set, or a vertex bake set.

Note	Typically, you don't change the attributes of the initial bake set, but if you need to modify one or two of the default settings, see "Adjust bake set attributes" on page 149.

How do I?

Create a bake set

You can create your own bake sets to be able to bake objects in different ways. To create a bake set, you must have an object in your scene that you want to assign to the bake set.

To create a bake set

1. Selected one or more objects for which you want to create a bake set.
2. Use *one* of the following methods to assign the bake set:
   - Click Light/Shading > Assign New Bake Set > Texture Bake Set (to create a Texture Bake Set) *or* Vertex Bake Set (to create a Vertex Bake Set).
   - Right click the object, then select Baking > Assign New Bake Set > Texture Bake Set *or* Vertex Bake Set.
   - Use the MEL command:

     ```
     createNode [textureBakeSet|vertexBakeSet]
     ```

     The new bake set's attributes appear in the Attribute Editor (unless the Attribute Editor has been hidden).
3. Adjust the bake set's attributes, see "Adjust bake set attributes" on page 149.

Adjust bake set attributes

To adjust the attributes of a bake set

1. Do one of the following:
   - If the bake set's attributes are shown in the Attribute Editor, proceed to the next step. (If you can't see the Attribute Editor, make sure it is not hidden.)
   - If the bake set's attributes are not shown in the Attribute Editor, right-click the object, then select Baking Attributes.
   - To select a bake set without selecting an object, you can select it from the tab that contains bake sets in the Hypershade. If you do not see a tab that contains bake sets, you must create one. See "Create a Bake Set tab in Hypershade" on page 150.
2. Adjust the attributes.

   For a description of the attributes, see "Texture Bake Set" on page 465 or "Vertex Bake Set" on page 469

Assign objects to existing bake sets

After you create a bake set, you can assign any additional objects you create to that bake set.

To assign objects to existing bake sets

- Assign each object, instance, or group to be baked to a bake set, using one of the following methods:
  - The Maya Relationship Editor

- Lighting/Shading menu > Assign Existing Bake Set > then choose from the list of existing bake sets.
- Right-click the bake set node in the Hypershade, then click Assign Selection to Bake Set.
- Right-click the object, then select Baking > Assign Existing Bake Set > then select the Bake Set.
- From the Hypershade, drag the bake set node onto an object in your scene.
- Use the MEL command. For example:

```
sets –add myBakeSet nurbsSphere2;
```

To change the attributes of the initial bake set

1. Select any object in your scene.

   The object's attributes appear in the Attribute Editor.
2. Select the initial bake set tab.
3. Set any of the attributes.

   To change the attributes of the initial texture bake set, see "Texture Bake Set" on page 465.

   To change the attributes of the initial vertex bake set, see "Vertex Bake Set" on page 469.

Create a Bake Set tab in Hypershade

You can create bake set tab in the Hypershade to be able to view and select bake sets.

To create a Bake Set tab

1. In the Hypershade, click Tab > Create New Tab.
2. In the Create New Tab window, type in the New Tab Name field a name, such as `Bake Sets`.
3. In the Show Nodes Which Are field, select Bake Sets.
4. Click Create.

7 mental ray for Maya Shading

About mental ray for Maya shading concepts

Ambient occlusion concepts

Definition of occlusion

Ambient occlusion refers to the blocking of indirect or diffuse light on an object. It refers to the darker areas of the object, typically creases, cracks and crevices. Ambient occlusion is caused by indirect light's inability to bounce around and illuminate areas that are blocked by a nearby object that absorbs the light rays. These subtle variations in lighting are visual clues for our eyes to detect surface details and distinctions that would otherwise be washed out and unnoticeable. Ambient occlusion adds realism to your scene by adding shadows in crevices, nooks and crannies, and so on. For each surface point, it calculates how much light is blocked by other geometry.

In the example below, the ice blocks stand out because of the shadowing between them. The cracks between the ice bricks appear darker because the light is blocked by the ice bricks. This is ambient occlusion.



Ambient occlusion adds shadows in the gaps between the igloo’s ice blocks.

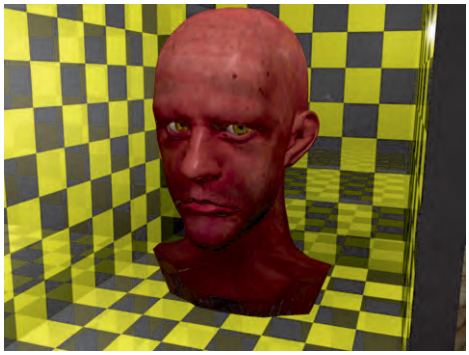
Applications of ambient occlusion

Sometimes the lighting in your scene may be too bright, thereby washing out surface details. Ambient occlusion emulates the shadows produced by an overcast sky — it brings out cracks and crevices while keeping the lighting soft throughout the scene. Use ambient occlusion if your scene contains a lot of occluded crevices or if you want to add soft shadows to your scene.

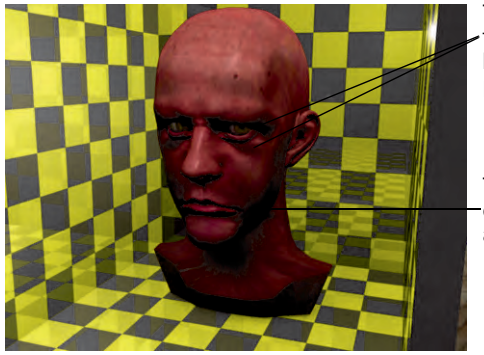
For example, a sample application of ambient occlusion is to create a pass for compositing.



Ambient occlusion pass



Beauty pass of scene

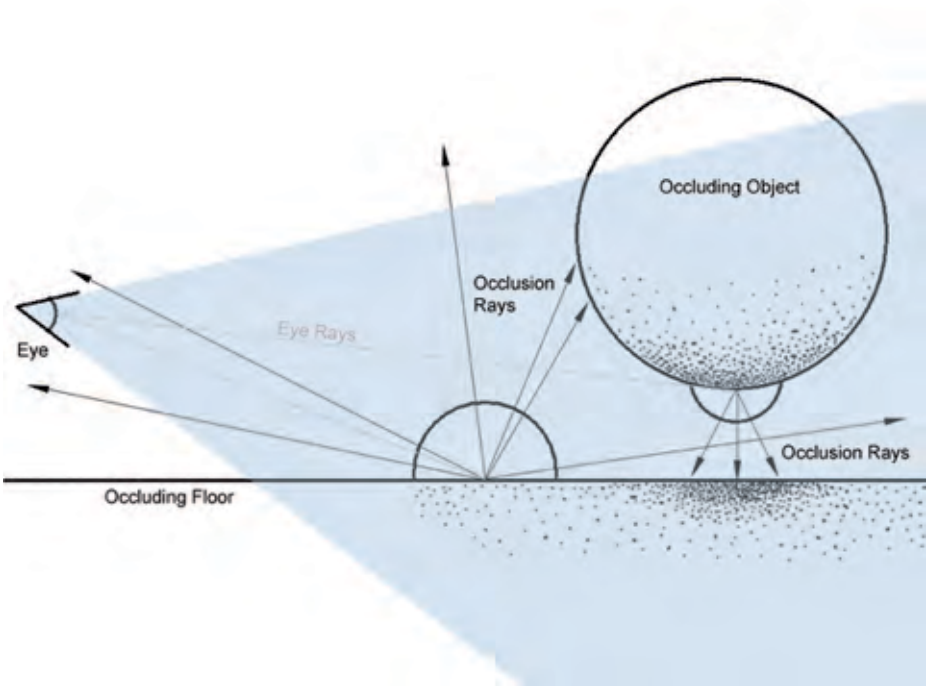


Beauty pass and ambient occlusion pass composited

Incorporating ambient occlusion in your scene

You can calculate ambient occlusion using the following methods:

- Using the mib_amb_occlusion shader. A number of *probe rays* are traced inside the hemispherical area above each point, and the probe rays determine the extent to which the area is blocked by other geometry in your scene.
- Using the mib_fg_occlusion shader. Rays are emitted from special final gather points created during the precomputation phase. By contrast, rays are emitted from the shading point when using the mib_amb_occlusion shader.
- Using the Transfer Map tool. Generate an ambient occlusion map from a high resolution object and then bake that map to the mesh of a low resolution object using the Transfer Map tool. This allows the low resolution object to appear to have ambient occlusion detail. For more information regarding the Transfer Map tool, see ”Transfer Maps” on page 40.



An occlusion shader has been mapped to the floor and the sphere. A hemisphere of rays are emitted above each point that test the amount of shadowing each point should receive.

Tip	The mib_fg_occlusion algorithm also uses filtering and therefore produces smoother results than that of the mib_amb_occlusion shader. Both the mib_fg_occlusion and mib_amb_occlusion algorithms treat semi-transparent objects as if they were opaque. Occlusion rays do not penetrate through these objects.

Note	Calculating occlusion using the mib_fg_occlusion shader is different from using final gather directly. In the former case, *bouncing of light does not actually occur*. The mib_fg_occlusion shader algorithm simply uses precomputed final gather points for emitting rays as well as the smoothing and filtering algorithms of final gather.

Baking occlusion in mental ray for Maya

To bake occlusion in mental ray for Maya, select Lighting/Shading > Batch Bake. Select Occlusion under Color Mode in the Texture (or Vertices) Bake Set Override section.

For more information regarding the batch bake option, see ”Lighting/shading > Batch Bake (mental ray)” on page 246.

Create occlusion files for external compositing

You can run an occlusion pass which renders ambient occlusion only. This can be used as your contact shadow pass. See ”Work with layer presets” on page 100 of the Rendering guide for more information.

Basics of mental ray for Maya shading

mental ray for Maya shaders

mental ray for Maya Shading nodes, such as materials, textures, and lights, allow you to expand the effects achievable when you render with mental ray for Maya.

mental ray for Maya shaders include the Maya Base shaders and Custom Shaders and Phenomena.

Maya base shaders

Maya comes with a collection of mental ray for Maya base shaders that you can assemble into a wide variety of shading networks. You can use the Maya base shaders exclusively or combine them with the standard Maya (or mental ray) shaders.

You use them the same way you do Maya materials, textures, lights, cameras, and so on. You can achieve sophisticated photorealistic and non-photorealistic looks with them.

For a complete description of Maya base shaders, see "mental ray for Maya nodes" on page 423.

Related topics

- "mental ray for Maya custom shaders" on page 162
- "Phenomena" on page 170

mental ray Shader connections

The following mental ray shader parameter types are recognized as message attribute by Maya: light, geometry, color texture, scalar texture, vector texture, lightprofile, shader.

Though it is possible to connect any node to these attributes, you should make only those connections that Maya expects, otherwise a crash or rendering abort may occur. That is, if you drag a node to the message attribute in the Attribute editor, the message attribute of the source node will be connected to the attribute (for example node1.message > mrShaderNode.shader), but only the following connections are recognized and will work in Maya:

- light : light transform node. For example, pointLight1.message > dgs_material1.lights[0]
- geometry : geometry shader. For example, mib_geo_sphere1.message > mib_geo_instance1.object
- shader : mental ray shader. For example, mib_illum_phong1.message > mib_geo_instance.material
- color texture, scalar texture, vector texture: mentalrayTexture node. For example, mentalrayTexture1.message > mib_texture_lookup1.tex. The button next to a color/scalar/vector texture attribute in the shader's attribute editor will create a new mentalrayTexture node, and connect it to the attribute.
- lightprofile : mentalrayLightProfile node. For example, mentalrayLightProfile1.message -> mib_light_photometric.profile. The button next to a lightprofile attribute in the shader's attribute editor will create a new mentalrayLightProfile node, and connect it to the attribute.
- input-to-input connections, that let you render more dependency graph connection in Maya scenes.

Note	Breaking an input-to-input connection causes all the dependent nodes in the chain to lose their inputs.

mental ray for Maya textures

Map a texture to your object to determine the appearance of its surface, or use a texture as a background or reflection map. You can choose between a procedural texture or a file texture.

File textures

File textures are bitmaps scanned from photographs, taken with a digital camera, or painted in a 2D or 3D paint package that you bring into Maya to use as a bitmap. File textures filter better than most procedural textures and can result in better image quality.

Note You can render an entire branch of a shading network to use the illumination, shadow, shading, and textures as a file texture (texture map) for the following reasons:

- To reduce rendering time of particularly complex networks or if mental ray's high-profile global illumination features are involved.
- To obtain lighting effects that would be difficult to achieve in other ways.

For more information see ”Baking illumination and color” on page 147.

HDR images as file textures (mental ray for Maya)

mental ray for Maya supports High-Dynamic Range (HDR) images as file textures.

For more information about HDR images, see ”High Dynamic Range Imaging (HDRI)” on page 82 in the *Lighting* guide.

Related topics

❖ ”2D and 3D textures” on page 29
❖ ”Procedural textures” on page 30
❖ ”File textures” on page 31
❖ ”Adobe Photoshop texture networks” on page 33
❖ ”Texture filtering” on page 34

mental ray for Maya reflections

There are two ways to create reflections in Maya: by creating true reflections and by simulating reflections.

You can create true reflections by raytracing your scene. However, although this technique creates realistic reflections, it also increases the complexity of your scene and demands a significant amount of rendering time. For more information on how to create true reflections, see ”True reflections” on page 135 and ”Create true reflections” on page 136.

mental ray has the added advantage of allowing you to create motion blurred images. To create an image that is more natural looking and blurry, see “Create blurry reflections using mental ray for Maya”.

Alternatively, you can simulate reflections to reduce rendering time by using a texture as a reflection map. For more information on how to simulate reflections, see “Simulated reflections”.

Related topics

- ”True reflections” on page 135
- ”Simulated reflections” on page 135
- “Create true reflections”
- “Simulate reflections with Env Ball”
- “Simulate reflections with Env Cube”
- “Simulate reflections with Env Sphere”

mental ray for Maya Surface relief

You can create surface relief for your object in two ways:

- By mapping a bump map to your object, which creates the illusion of surface relief (elevations and depressions) on an otherwise flat object. See ”Bump maps” on page 112.
- By mapping a displacement map to your object, which creates true surface relief (elevations and depressions) on an otherwise flat object. See ”Displacement maps” on page 113.

Related topics

- ”About surface relief” on page 111
- ”Bump maps” on page 112
- ”Displacement maps” on page 113
- ”Feature-based displacement” on page 115

mental ray for Maya displacement

You can displacement map all mental ray for Maya geometry types (polygon meshes, free-form objects (NURBS curves/surfaces), and subdivision surfaces.

mental ray uses an adaptive tesselation approach to better fit the details of the displacement map. The initial tesselation (for NURBS: after surface approximation) is further subdivided to fit secondary criteria, controlled by the displace approximation settings. By default, mental ray for Maya creates appropriate settings that lead to curvature dependent subdivision of the triangles, one form of feature-based displacement mapping. You can change these settings by creating or selecting a custom displace approximation node in the Approximation Editor (mental ray > Approximation Editor).

Tip	It's important to specify an accurate Max Displace value for the objects being displaced. The typical approach is to derive this value from Maya's Bounding Box Scale, but this is not suitable in all cases. As an alternative, you can use the Max Displace setting (Render Settings window, mental ray tab, Render Options > Overrides > Displacement section) to control shape nodes. To determine the right value, set the Max Displace to 0, and adjust it according to the messages in the Output window.

Related topics

❖ "Displacement maps" on page 113

mental ray atmospheric effects

Fog, smoke, dust, and silt

Maya's volumetric materials and mental ray for Maya's volumetric materials let you simulate fog, smoke, dust, or other atmospheric effects.



mental ray for Maya's participating media.

You can create atmospheric effects such as fog, smoke, dust in the following ways:

- For basic spherical, conical or cubicle effects, create the appropriate Maya volume primitive, then assign a Maya volumetric material to it, then render with Maya software.
- For more complex shapes, create any geometrical object, then assign a Maya volumetric material to it, then render with mental ray for Maya.
- Use mental ray for Maya's participating media. The workflow involves assigning a transfer material to achieve physically accurate light participation, with the potential to generate shadows and caustics.

(Alternatively, you can create the effect in post production (that is, outside Maya).)

Related topics

❖ "Simulate fog, smoke, or dust" on page 141
❖ "Change the visual effect of fog, smoke, or dust" on page 143

Baking textures and prelighting in mental ray for Maya

Baking illumination and color

In a typical scene, you shade, texture, and light objects to create the look you want, then you render. You can instead pre-render materials, textures and illumination in a process called baking (by render experts) or prelighting (by modeling experts).

Baking effectively freezes the illumination (and shadow and surface color, if wanted) of baked objects into an image file (if you bake to textures) or data (if you bake to vertices) that you can later apply to objects.

After you bake objects and apply the prerendered illumination to objects, you can simplify the scene by removing lights, materials, and textures (shading networks). Instead of computing illumination at render time, the renderer instead obtains it quickly from the applied file image or data that is produced (depending on what you bake to – textures or vertices).

When to bake objects

- To accelerate time- and processor-intensive renders, particularly for complex shading networks or if mental ray for Maya's global illumination features are involved.
- To optimize renders for use on simpler display devices (such as a console game rendering engine).
- To achieve lighting effects that would otherwise be difficult to achieve in other ways.
- Export to a platform that does not support certain shading effects. For example, some graphic APIs only support a limited number of lights, and many platforms have a limited amount of texture memory available. If you bake the effects of the lights and textures onto the geometry, the lights and textures can then be removed from the scene.

Note	In Maya, baking is called Convert to File texture. See "Convert a texture or shading network to a File Texture" on page 81.

Related topics

❖ "Bake sets" on page 148

Baking to textures and vertices

Updated

You can bake to textures and vertices in mental ray for Maya.

Note	Selecting a surface (A) and baking it, then selecting another surface (B) and baking it is not the same as selecting two surfaces (A and B) and baking them together. This is more noticeable with global illumination, where objects bounce and absorb the light of other objects in a scene. Once an object is baked it's assigned a surface shader and it no longer reflects light within the scene.

Baking to textures

When you bake to textures (as opposed to vertices) an image file called a light map is created. You can use this light map, which contains the material(s), texture(s), and illumination of the baked objects, as a file texture to apply to the object.

Find this light map image file (by default) in the following location:
`Maya\projects\mentalray\lightMap`

Baking to vertices

When you bake to vertices (as opposed to a texture) data is created and automatically stored in the polygon mesh's vertex colors.

A sample can either be stored as color-per-vertex, or used to displace the position of a vertex.

- If stored as a color-per-vertex-per-face color, RGB color and alpha (transparency) is stored.
- For displacement, the X,Y,Z coordinates of the vertex position changes. Since a sample contains four channels (RGBA), the displacement uses the luminance value of the color.

You can export this data as a texture map.

Baking Occlusion

New

Baking occlusion (using the Occlusion Color Mode in Texture Bake Set or Vertex Bake Set) is controlled by the corresponding attributes in the Texture Bake Set or Vertex Bake Set.

When baking to a texture, occlusion is also computed differently depending on whether Final Gathering is enabled. When final gathering is disabled, occlusion is computed for every pixel in the texture. When it is enabled, occlusion is precomputed at a few selected pixels and then interpolated.

The first method (where final gathering is disabled) is slower by comparison; however, it captures small details in your scene. The interpolation method (where final gathering is enabled) is usually faster and produces smoother images. It is particularly useful for baking textures on low-res poly meshes.

Related topics

❖ "Create lightmaps by baking textures and vertices" on page 187
❖ "Baking illumination and color" on page 159
❖ "Bake sets" on page 148

Baking with final gather

Updated

Final Gather

In regular rendering, Final Gathering precomputes Final Gather points based on the current view of the camera to achieve good quality for the particular view you are rendering.

This global precomputation step does not happen during baking. Instead, Final Gather points are precomputed for each texture that is being baked.

Note	By comparison, the precomputation process used during baking is slower than the global precomputation process during regular rendering because Final Gather points are also precomputed on geometry that is otherwise invisible from the current camera.

The quality of the precomputation step is controlled by the attributes Final Gather Quality and Final Gather Reflect which can be found in the Texture Bake Set node. In addition, you can also tweak the Final Gathering attributes in the Render Settings: mental ray tab. In particular, you may need to tune Accuracy and Point Interpolation, while Point Density has no effect on baking.

❖ ”Troubleshoot baking quality with final gather” on page 204
❖ ”Baking illumination and color” on page 159
❖ ”Bake sets” on page 148

Limitations of baking to textures

Updated

The following limitations apply when baking to textures:

- motion blur may not appear in light maps
- volumes and fog are not recognized in light maps

mental ray for Maya custom shaders

Custom shaders

Custom shaders are custom-coded mental ray shaders that let you create looks over and above those that can be achieved with the standard mental ray for Maya Base shaders. You (or third-party developers) can create them in C or C++ language, then process them into modes that you can see and use in Maya.

A collection of custom shaders (one or more) make up a Custom Shader Library. Custom shaders are typically distributed in custom shader libraries. To see a particular custom shader in Maya, you must load the shader library that contains that custom shader. See "Load shaders" on page 195.

Custom mental ray shaders with color attributes create corresponding RGBA attributes in Maya. This means that the alpha_component of color values on custom shaders can drive or can be driven by Maya shading networks.

Custom shaders written for Maya's Software renderer can be related to mental ray for Maya custom shaders. The correspondence is driven by an .mi declaration that is loaded in the Shader Manager. Then, mental ray for Maya detects the corresponding Maya shading node. The corresponding parameters (attributes), and connections to other supported nodes (Maya or custom nodes) are associated. As a result, you can create a single shading network that is compatible for both Maya and mental ray rendering. See "Relate Maya custom shaders to mental ray for Maya custom shaders" on page 197.

Custom shader libraries

Custom shaders are distributed in custom shader libraries. To see a particular custom shader in Maya, you must load the shader library that contains that custom shader. A custom shader library consists of two files:

- a declaration file (for example, `mayabase.mi`) that contains descriptions of the interfaces of the shaders
- a library file (for example `mayabase.so` or `mayabase.dll`) that contains the actual implementations of the shaders

The Node Factory (see "The Node Factory" on page 163) creates the Maya-type nodes from your custom shader declarations. These nodes work just like regular Maya nodes: you can use them to build shading networks; you can save, load, and export them; you can write your own Attribute Editor templates; and you can provide icons, swatches, and help files. See the devkit for more information and examples.

The Node Factory

The Node Factory is a special part of mental ray for Maya that creates Maya-type nodes from custom shader declarations and Phenomena declarations. (When you export an assembled shading network to be used a Phenomenon, the network is exported to the `.mi` declaration file.)

The Node Factory parses the declaration and packs it into a single node—a shader or Phenomenon, depending on what you are creating.

To see each node type being created in the Script Editor, set option Var miFactoryVerbosity to 4 or higher.

Successfully created node types are available in Create Node window (Hypershade > Create Node window > Create mental ray nodes), either in the Miscellaneous section or one of the other sections (if the appropriate flag was set when you wrote the shader or exported the Phenomenon).

The Node Factory Parser

The Node Factory parser accepts any valid mental ray shader or Phenomenon declarations and special extensions. Messages are written to the Script Editor to inform you about parsing progress and any errors that have occurred.

Parsing error messages

The parser prints the name of the file it is processing. If an error occurs, the line number and a hint of what the parser actually expected are written.

Note	The Factory Node parser does not understand the full mental ray syntax, so parsing errors frequently occur within Phenomenon declarations when unknown shader requirements or commands are encountered. The parser recovers from these errors without harm and proceeds.

Unrecoverable errors occur only if the syntax of parts of a shader or phenomenon declaration is wrong. The parser is unable to recognize, for example, commas in the parameter lists are missing. In such a case, the declaration is discarded.

mental ray shader language extensions

Naming guidelines

- Attribute names and short names must be unique per node. For example, children of different compounds must not have the same name or short name.
- Node type names and IDs must be unique.

Syntax extensions for Maya specials

You can provide additional parameters for each attribute on a node, and the node itself. Because there are no counterparts for these parameters in mental ray's scene description language, the Factory parser has been extended beyond the standard mental ray syntax to recognize certain keywords that can be given on a per attribute or per shader or phenomenon basis.

Add additional attributes with keywords

You can provide additional parameters for each attribute on a node, and the node itself by including keywords in the `.mi` declaration file.

These keywords must be prefixed with #: so that the declaration files are still accepted by the standard mental ray parser; these keywords are ignored by the standard mental ray parser (but not the Node Factory parser) because they are recognized as comments. Special comments in wrong places or syntactically wrong #: comments cause parse errors, which are written to the Script Editor.

Where to put keywords and what to write

Such #: comments can appear in two places: after a shader parameter or phenomenon parameter or in the requirement section of a declaration.

- After a parameter, the following syntax is valid:

```
default scalar [scalar [scalar]]
max scalar [scalar [scalar]]
min scalar [scalar [scalar]]
shortname "string"
softmax scalar
softmin scalar
hidden boolean
```

- In a declaration's requirement section, the following is syntactically correct:

```
nodeid integer
```

If none of these additional keywords are provided, the default is zero; the min/max and softmin/softmax are undefined; and the short name is uniquely assigned by counting attributes on nodes. Likewise unique node IDs are determined by counting nodes.

For attributes, not every keyword makes sense for every attribute type. The following is supported by Maya and thus by the Node Factory:

mental ray type	Maya type	default	min/max	soft min/max
boolean	boolean	0/1		
color	float3	3 scalars		
integer	long	1 integer	1 integer	1 integer
scalar	float	1 scalar	1 scalar	1 scalar
vector	float3	3 scalars	3 scalars	

Short names

Short names can be given to every attribute. The Factory appends R,G,B to color children names/short names and X,Y,Z to vector children names/short names.

Example 1 (of 2):

```
declare shader
       vector                                  #: shortname "ov"
       "multiplyDivide" (
              integer        "operation",     #: default 1 min 0 max 2
              vector         "input1",        #: default 1. 1. 1.
              vector         "input2"         #: default 1. 1. 1.
```

```
            )
        #:
        #: nodeid 6894 # This is the node ID for binary Maya files.
        #:
        version 1
end declare
```

Example 2 (of 2):

```
declare shader
        struct {
                color           "outColor",     #: shortname "oc"
                scalar          "outAlpha"      #: shortname "oa"
        } "ramp" (
                array struct    "colorEntryList" {
                        scalar          "position",
                                #: default 1.
                        color           "color"
                                #: default 0.8 0.8 0.8
                        },
                        #: shortname "cel"     # compound's short name
                scalar          "uWave",
                        #: shortname "uw"
                        #: default    0.5
                        #: softmin   1E-5 softmax 1
                        #: min    1.0E-05 max     1
                scalar          "vWave",
                scalar          "noise",
                scalar          "noiseFreq",
                scalar          "hueNoise",
                scalar          "satNoise",
                scalar          "valNoise",
                scalar          "hueNoiseFreq",
                scalar          "satNoiseFreq",
                scalar          "valNoiseFreq",
                # Inherited from Texture2d
                vector          "uvCoord",
                        #: shortname "uv"
                vector          "uvFilterSize",
                scalar          "filter",
                scalar          "filterOffset",
                boolean         "invert",
                        #: default 0
                boolean         "alphaIsLuminance",
                        #: default 1
                color           "colorGain",
                        #: default 1.0 0.8 0.8
                        #: min 0.1 0.1 0.1 max 0.5 0.5 0.5
                color           "colorOffset",
                scalar          "alphaGain",
```

```
                #: shortname "ag"
            scalar          "alphaOffset",
                #: shortname "ao"
            color           "defaultColor"
            )
        #:
        #: nodeid 6895 # Node ID for binary Maya files
        #:
        apply texture
        version 2
end declare
```

The Factory parser syntax vs. the mental ray parser syntax

Details about what the Factory parser does not accept, but mental ray's parser does:

- Missing zeros before the dot in a scalar value are not supported. Instead of .5 you should write 0.5. Missing zeros after the decimal are supported, so 5. is acceptable.
- There must be no comma after the last parameter in the input parameter list of a shader declaration. mental ray accepts

```
declare shader
            vector
            "reverse" (
            vector "input",
            )
end declare
```

The Factory parser reports a syntax error at the comma.

Hooks

The Factory creates Maya nodes from mental ray shader declarations. Once created, each such node represents a custom mental ray shader (a shader definition, to be precise). It can conveniently be used with various Maya scene entities.

Message attribute

The following mental ray shader parameter types are registered as message attribute by node factory: light, geometry, color texture, scalar texture, vector texture, lightprofile, shader.

Though it is possible to connect any node to these attributes (if you drag a node to the message attr in the Attribute editor, the message attribute of the source node is connected to the attribute. For example node1.message -> mrShaderNode.shader), you should make a proper connection. Otherwise, it may lead to crash or rendering abort.

The following are expected to be connected to each mental ray shader parameter type.

- light : light transform node. For example, pointLight1.message -> dgs_material1.lights[0]
- geometry : geometry shader. For example, mib_geo_sphere1.message -> mib_geo_instance1.object
- shader : mental ray shader. For example, mib_illum_phong1.message -> mib_geo_instance.material
- color texture, scalar texture, vector texture: mentalrayTexture node. For example, mentalrayTexture1.message -> mib_texture_lookup1.tex
  The button next to a color/scalar/vector texture attribute in the shader's attribute editor will create a new mentalrayTexture node, and connect it to the attribute.
- lightprofile : mentalrayLightProfile node. For example, mentalrayLightProfile1.message -> mib_light_photometric.profile
  The button next to a lightprofile attribute in the shader's attribute editor will create a new mentalrayLightProfile node, and connect it to the attribute.

Materials

Custom materials may be specified in the shading group node. In the Attribute Editor, go to the mental ray section of the shading engine created along with this shader. Turn on Suppress all Maya shaders and connect the desired custom shaders to the corresponding attributes. The shading engine is now going to be exported as a mental ray material. You may still assign it to Maya objects in the usual ways.

Lights

You may specify a custom light shader in the mental ray section of any Maya point, spot or directional light. Turn on Suppress all Maya shaders and connect your light shader. On export, this overrides the default Maya shader while other properties of the light (orientation, spot cone angle, and so on) are preserved.

Cameras

Provide your own output, volume, lens, and environment shaders in the Attribute Editor’s mental ray section of any camera shape node. Currently you cannot specify more than one output shader.

Transforms

It is possible to override a shape node attached to a transform with a custom geometry shader. Just turn on Enable geometry shader in the mental ray tab of Maya's transform nodes. Ideally, the transform node should have a single shape child.

Textures

The mental ray texture node should be used. mental ray Texture can be created from the Attribute Editor of a shader with “color texture, scalar texture, vector texture” parameter, and will be connected to the shader.

Swatch rendering in mental ray for Maya

You can now see visual representations of mental ray for Maya shading nodes in swatch form in Maya. For example, you can now view mental ray for Maya custom shaders, when the appropriate renderer (mental ray for Maya renderer) is selected.

Notes

- In mental ray for Maya, swatch rendering is supported for: material shaders, procedural texture shaders, sample compositing shaders, and data conversion shaders.
- For interactivity, mental ray shader swatches are rendered in low rendering quality.
- To maintain maximum performance when IPR is running, swatches in Hypershade are not updated.

File swatch vs. Interactive swatch

The classification string of the shading node determines whether the swatch is a file swatch or an interactive swatch. A file swatch appears in the Hypershade as a static icon, while the interactive swatch dynamically updates.

Swatch type	Classification string contains...
file swatch	mentalRaySwatchGen
interactive swatch	swatch/mentalRaySwatchGen

Classifications strings are registered when the shading node is registered, upon start up of Maya. In order to change the classification string of a particular shading node, you must edit the `mentalrayCustomNodeClass.mel` file, before starting Maya. You can find this file in `<maya directory>/scripts/others`.

To check the classification string of a shading node, use the following MEL command:

```
getClassification <nodeType>
```

where `<nodeType>` is the shading node you want to check. For example:

```
getClassification mib_illum_lambert;
```

Advanced mental ray for Maya shading

Phenomena

Phenomena are mental ray for Maya components that look and behave like shaders but, unlike custom shaders, they require no programming knowledge of C or C++ code to create.

By exporting an assembled shading network (or portions of it) and designated attributes, you create a Phenomenon, a single node that you can then use just like a regular shader: you can build shading networks with them; save, load, and export them; write your own Attribute Editor templates; and provide icon, swatches, and help files. See the devkit for more information and examples.

Phenomena:

- Provide you with a simpler way of creating complex looks for objects other than creating custom shaders.
- Can be created during the earlier phases of production and then optimized or coded into custom shaders for later stages of the production.
- Let you restrict simplify the number and type of adjustable attributes made available to Maya artists. This provides you with a unified pallet and more control over the looks that can be achieved.

Previously generated phenomena

In order for the Node Factory to find and generate in Maya previously exported Phenomena, you need to:

- Export the file (for example, `my_phenomenon.mi`) to the directory specified in the environment variable: `MI_CUSTOM_SHADER_PATH`. The default value of this environment variable is: C:\Program Files\Autodesk\Maya8.5\mentalray\include.
- Specify to the Node Factory to generate the node at every Maya startup. To do this, you must edit the `maya.rayrc` file, located (by default, for example) in C:\Program Files\Autodesk\Maya8.5\mentalray

Note Editing the `maya.rayrc` file is optional. By default, mental ray for Maya looks for shader libraries in the default install directory:

`...\Autodesk\Maya8.5\mentalray`

If your shader libraries are not located in the default directory, you must use the `maya.rayrc` file so that Maya can see your shaders. See, ”Edit the maya.rayrc file” on page 193.

- Add the following line:
  `mi "{MAYABASE}/include/my_phenomenon.mi"`

Custom mental ray text

mental images .mi files are created with the mental images scene description language, which can be either an ASCII or binary file.

In mental ray for Maya, you can write and insert a text-only integration of custom mental ray shaders within Maya. It allows creation of special-purpose Maya nodes that hold customized mental images (.mi) text.

You can assign these nodes to certain Maya scene entities with the help of the Custom Text Editor and special custom text controls.

The mi file generated with mental ray for Maya can contain customized versions of: camera output statements including lens, volume, and environment shaders, light shaders, material shaders, texture or utility shaders, and object definitions. Furthermore, text can be generated that is written at certain stages of the export.

For more information, see "Assign custom text to an object or shader" on page 199.

Customize Scene Entities

The mental ray for Maya plug-in provides a proprietary type of node, the mentalrayText node. It comes with a simple user interface that allows editing ASCII text. For more information, see "Assign custom text to an object or shader" on page 199.

You can connect these nodes to other nodes in the scene in certain situations using the Custom Text Editor.

The mentalrayText node assignment to Maya nodes is done on a .mi Text in the Extra Attributes section. mental ray for Maya checks for this new attribute when traversing the scene and shader graphs. If it has been found, the contents of the connected mentalrayText is written without further checks.

Warning

The translation of such entities has been disabled by default for interactive preview rendering due to several unpredictable issues. It is enabled for the .mi file export to create customized scene files for external rendering.

Dependent on the text mode attribute, the custom text is appended, prefixed, or completely replaces existing text in the generated .mi text.

The Maya renderer ignores these extra attributes and can render the scene safely as usual. On the other hand, the changed scene may not render any more with mental ray because of broken dependencies between lights, objects, and materials. See "General Notes" on page 173.

The scene needs to be saved as a Maya Binary (.mb) file in order for the text nodes and its connections to be preserved.

CustomText Editor control group support

The Custom Text Editor contains two rows of drop-down lists and buttons that are dimmed by default.

When selecting objects or shaders in Maya the Custom Text Editor is updated according to the selected entity and enables the appropriate control if the current selection allows creation and assignment of custom .mi text.

The two control groups support:

- custom shader text

  It is enabled when selecting any light, any camera, any shading group, except the initial variants, any shader, except Maya's default lambert1 and particleCloud1.
- custom object text

  It is enabled when a mesh or NURBS shape is selected. If a direct transform of a shape is selected, the underlying shape is automatically determined and used.

Custom Text Variables

The custom text can make use of special placeholder characters or strings that are recognized during translation. They are replaced by actual values on export. Right now, there is just one such variable supported: the at sign (@) is a placeholder for the current frame number.

What happens when assigning text to entities

When creating a custom text node and assigning it to the selected node in the scene the Attribute Editor is updated.

The option menu lists all the available text nodes that were previously created. By selecting a new entry in this option menu the text assignment of the current scene entity is replaced with this newly chosen text node. Saving the scene to a Maya file also stores all the existing text nodes, both connected and unconnected. Custom text nodes have to be deleted by standard Maya methods, as the Custom Text Editor doesn't provide a way to do it.

Types of text assignments

Camera Output and Shaders

The text node assigned to a camera adapts the first output statement that is created by the plug-in. Thus, customized image files and framebuffers can be created. Furthermore lens, volume and environment shaders can be added. The other camera parameters are unaffected and is still written according to the settings set in Maya.

Light Shaders

The text node assigned to a light affects the original light shader output. The light parameters remain unchanged and are written as usual. Using alternatives to standard Maya light shaders break illumination of Maya materials since they depend on special light dependency nodes.

Material Shaders

A custom text node assigned to a shading group affects the export of mental ray materials. If text is applied in replace mode the connected surface, volume, and displace shaders won't be exported at all. Otherwise, those shaders are written as usual, including their own dependent nodes.

The custom text editor prefixes the name of the currently selected entity with *&out;material* to inform about its intended use.

Other Shaders

Text nodes can also be assigned to any other shading node that is supported in the translation process. The editor enables the controls in case such a supported node was selected, and prefixes the type of the node to the name of the selected entity. This relates to all texture and utility nodes. Using this feature, graphs of custom text nodes can be created and exported. mental ray for Maya ensures proper export of the graph, where leaf nodes get exported before dependent nodes, even if they contain custom text. This way, custom text itself can contain references to nodes down the graph. There is one limitation: custom text is expected to not use any shaders that return structures. In connections, they are always written with only their node name—not appended with names of output plugs for example, `.outColor`.

Object Definitions

Custom text assigned to shape nodes affects the complete object definition except the object's name and its flags. In text replacement mode, the flags are written according to the settings in Maya, but can further be adapted in the custom text. Also, the exported object is tagged by default, thus the custom object definition should use a material tag number instead of a material name.

The actual material is assigned in the instance statement, which gives a list of materials, one for every tag number. This way, different instances of the same object, and even polygons out of a mesh object, can get different materials.

General Notes

- Unfortunately, the custom text functionality does not prevent you from creating invalid mi scenes that don't render any more or produce unexpected results. Therefore, great care should be taken to avoid undesired custom text.
- Text is printed in the `.mi` file without any further indentation. This is required for certain mi commands that are expected to start at the first column of a line.

- The $include statement can be used anywhere in custom text to take the actual mi text from external files (this statement has to start in the first column of the line), but note that the actual inclusion is resolved at render time on the render host.
- The original names of the Maya entities stay untouched and cannot be changed with custom mi text.
- Placing comments around the text (starting with #) makes the identification of the custom parts in the `.mi` file much easier.
- When a custom text node has been assigned to a Maya node, the newly created attribute mi text appears in the Extra Attributes section of that object's Attribute Editor. Clicking the button in the text field displays the appropriate text field.
- When using references to light in custom shader text, the Maya light names should be used.

Limitations

The non-deletable default lambert1, particleCloud1, initialShadingGroup, and initialParticleSE nodes deny storage of the extra text assignment if the scene is saved to a Maya file and later restored because they are handled in a non-standard way. The text nodes are stored, but the connection to these nodes are lost and has to be repeated. Any other Maya surface node saves and restores as expected.

The custom text nodes support limited animation. When exporting an animation, the regular node attributes are checked for changes from frame to frame, and the node gets incrementally exported in every subsequent frame. This happens even if custom text is attached.

No checks for the correctness of the mi syntax and the use of valid name references in the custom text can be made.

A custom text node that contains empty text and is not going to be appended but is connected to an entity removes the output of the shader or object to which it belongs.

Scenes containing both customized text and standard Maya nodes can't be expected to successfully render with mental ray anymore, especially when using customized light nodes, due to limitations with Maya light dependencies.

Custom text is expected to not use any shaders which return structures. In connections they are always written with only their node name—not appended with names of output plugs for example, `.outColor`.

Custom vertex data

For polygon meshes, mental ray for Maya checks for additional custom attributes with the fixed prefix "miCustomTex".

All characters after this prefix are considered the custom data's name, for example `MyData` for the attribute name "miCustomTexMyData". These data attributes are recognized and translated to additional mental ray texture spaces if they meet the following requirements:

- their type is one of (in MEL):
  - Int32Array
  - doubleArray
  - vectorArray
  - pointArray
- respectively (in Maya API):
  - MFnIntArrayData
  - MFnDoubleArrayData
  - MFnVectorArrayData
  - MFnPointArrayData
- the number of array data elements exactly matches the number of vertices in the mesh object

These array attributes can be created either by MEL or the Maya API. They should contain values when processing starts, otherwise they are ignored.

The data elements of the array attribute is attached to the mesh vertices in the presented order. According to the data type, they occupy one or more texture spaces in mental ray. This implies a data type conversion to floating point format in any case. It also ensures that the vertex data are automatically be interpolated for the current intersection point on a triangle.

Maya type	number of elements	mental ray texture access
int	1	tex_list[i].x
double	1	tex_list[i].x
vector	3	tex_list[i].x, tex_list[i].y, tex_list[i].z
point	4	tex_list[i].x, tex_list[i].y, tex_list[i].z, tex_list[i+1].x

The information about the texture space that is actually used for a certain custom array is still missing. In the current mental ray for Maya, exactly one texture space is reserved for texturing by default. But meshes can hold more than one UV space. Therefore, all custom vertex data start at an arbitrary texture space offset. If more than one custom array is attached to a mesh, the order of the attributes as listed on the node determines the texture space sequence in mental ray.

This actual layout of the data needs to be supplied to the shaders that want to make use of it. Two ways are currently implemented: user data and custom text replacement. The user data approach attaches a user data block to the mesh object in mental ray. This can be retrieved in shaders. The declaration of the data block *maya_vertexdata* is contained in the `mayabase.mi` declaration file.

If custom text is applied to the material of the mesh, a special placeholder syntax allows convenient parameter value assignment. The following placeholders are supported (examples assume custom data of type *vector* with name "MyData" found as first custom attribute):

placeholder	replaced by	example
$<name>	texture space index	$MyData -> 1
$<name>Offset	texture space index	$MyDataOffset -> 1
$<name>Size	number of used texture components	$MyDataSize -> 3
$<name>Type	custom data type, 1 - int, 2 - double, 3 - vector, 4 - point	$MyDataType -> 3

Note The placeholders are case sensitive. The use of the special dollar sign ($) for other than the placeholder names should be avoided.

Example

This is a complete example of custom vertex data and a custom text shader connected to a mesh with the following custom attributes:

- miCustomTexMyInt (Int32Array),
- miCustomTexMyDouble (doubleArray),
- miCustomTexMyVector (vectorArray),
- miCustomTexMyPoint (pointArray).

The custom text connected to the material looks like this:

```
int "$MyInt"
int offset "$MyIntOffset"
int type "$MyIntType"
int size "$MyIntSize"
double "$MyDouble"
double offset "$MyDoubleOffset"
double type "$MyDoubleType"
```

```
double size "$MyDoubleSize"
vector "$MyVector"
vector offset "$MyVectorOffset"
vector type "$MyVectorType"
vector size "$MyVectorSize"
point "$MyPoint"
point offset "$MyPointOffset"
point type "$MyPointType"
point size "$MyPointSize"
"offsets" [$MyInt $MyDouble $MyVector $MyPoint]
"sizes" [$MyIntSize $MyDoubleSize $MyVectorSize $MyPointSize]
"types" [$MyIntType $MyDoubleType $MyVectorType $MyPointType]
```

In the exported `.mi` file the text has changed to:

```
int "1"
int offset "1"
int type "1"
int size "1"
double "2"
double offset "2"
double type "2"
double size "1"
vector "3"
vector offset "3"
vector type "3"
vector size "3"
point "4"
point offset "4"
point type "4"
point size "4"
"offsets" [1 2 3 4]
"sizes" [1 1 3 4]
"types" [1 2 3 4]
```

The exported user data block on the polygon mesh shows up as:

```
data "plane:vxdata"
       "maya_vertexdata" (
              "magic" 1298749048,
              "data" [{
                            "name" "Int",
                            "type" 1,
                            "size" 1,
                            "offset" 1
                            },{
                            "name" "Double",
                            "type" 2,
                            "size" 1,
                            "offset" 2
                            },{
                            "name" "Vector",
```

```
                "type" 3,
                "size" 3,
                "offset" 3
                },{
                "name" "Point",
                "type" 4,
                "size" 4,
                "offset" 4
                }
        ]
)
```

Using either the placeholder syntax or the user data block, custom shaders can be written that can safely retrieve the custom data at the appropriate places.

Advanced information

The following information is for advanced users of mental ray and mental ray for Maya.

Custom nodes

The following node types are added to Maya after loading the plug-in and opening one of the mental ray editors:

- mentalrayItemsList
- mentalrayGlobals
- mentalrayOptions
- mentalrayFramebuffer
- mentalrayCurveApprox
- mentalrayDisplaceApprox
- mentalraySurfaceApprox
- mentalraySubdivApprox
- mentalrayPhenomenon
- mentalrayText

Nodes of these types are under control of mental ray for Maya and the user interface extensions. With the help of specialized editors the attributes of these nodes can be manipulated and custom connections can be made.

The mentalrayOptions and mentalrayFramebuffer nodes are used to hold most of the settings and properties to control the rendering options of mental ray. A number of convenient presets are available to start with. New nodes can be created within the Render Settings window. Their values are initialized to the default settings of mental ray for Maya, if appropriate. Existing nodes can be deleted as usual in Maya; they are removed from the UI the next time the Render Settings window are forced to update.

The mentalrayOptions node is the main entry for manipulating quality, performance, and features of mental ray.

The mentalrayFramebuffer node determines the output properties of the final image, like resolution, aspect, data type and image format. This way, any information of a rendered framebuffer can be saved to an output file. It's important to note that the Maya camera carries other attributes that are respected during image generation: if the Z Depth attribute is enabled then a depth file are rendered additionally to the usual color image. It gets the same name as the image file with "Depth" appended. This is saved in the mentalDepth proprietary file format, which can be viewed and converted with the imf_disp and imf_copy tools provided with mental ray. There is a way to change the default depth image format.

The mentalrayText node is used to hold custom mi text. It's the basis for the current implementation of custom shader support.

In general, those attributes that are guaranteed to be supported and recognized in the plug-in are exposed in the user interface with a descriptive name. Most of the attributes of the Render Settings node mentalrayGlobals are working similar to the matching ones in the Maya Render Settings. For details about the mental ray Render Settings, see ”Render Settings window” on page 265 in the *Rendering* guide.

The mentalrayCurveApprox, mentalrayDisplaceApprox, mentalraySurfaceApprox, and mentalraySubdivApprox nodes hold information regarding mental ray approximation of geometric entities. They should be handled and applied with the help of the Approximation Editor. For more information, see ”Obtain quads for subdivision surfaces” on page 178 in the *Rendering* guide.

Custom Commands

The following additional commands are available in *Maya* after loading the plug-in:

- Mayatomr
- MayatomrJob
- convertLightmap
- miProgress

The Mayatomr command executes the main functions of the plug-in. It controls the actual translation of the scene animation, takes care of the rendering and preview inside Maya. The MayatomrJob command is used to call MEL procedures on certain plug-in events. The miProgress command is used to display export progress in Maya, and can be used to interrupt the translation by pressing the Escape key. Both commands are executed and controlled via the custom user interface.

mental ray for Maya reference links

mental ray for Maya shading menu items

The following is a list of mental ray for Maya specific menu items.

mental ray Shader Manager window

Open the mental ray Shader Manager window to load and unload your custom mental ray shaders. For more information, see:

"Window > Rendering Editors > mental ray > Shader Manager" on page 243

Rendering menu set: Lighting/shading menu

Use these menu items to bake to textures or bake to vertices, or to batch bake selected objects:

- "Lighting/shading > Assign New Bake Set" on page 245
- "Lighting/shading > Batch Bake (mental ray)" on page 246

mental ray for Maya shading windows and editors

See the following for a description of the mental ray custom text editor:

- "mental ray Custom text editor" on page 275

mental ray for Maya shading nodes

The following is a list of mental ray for Maya shading nodes:

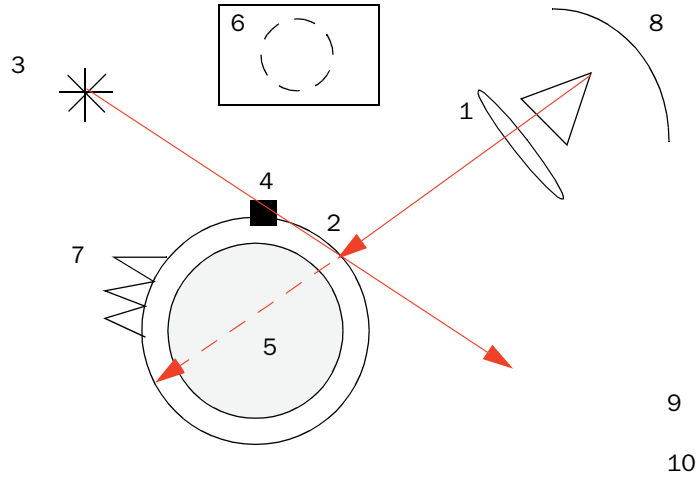
- "mental ray for Maya nodes" on page 423
- "Texture Bake Set" on page 465
- "Vertex Bake Set" on page 469
- material node: mental ray specific attributes
  - "mental ray" on page 345
- shading group node: mental ray specific attributes
  - "Shading Group attributes" on page 365

How do I? Basics of mental ray for Maya shading

Use a mental ray for Maya shader

You can use mental ray for Maya shaders the same way you use Maya materials, textures, and other render nodes; you build shading networks out of them in Hypershade. See "Connect render nodes using their default connections" on page 61.

The following shows where in a scene specific mental ray for Maya nodes are typically connected:



1 Lens shader. Attaches to camera.

2 Surface shader. For surface effects (Blinn, Phong, and so on). Attaches to Shading Group.

3 Light shader. For lighting style (point, spot, and so on), and shadowing controls. Attaches to light.

4 Shadow shader. Called when a shadow ray hits an object. Overrides the appearance of the object to shadow rays (color, transparency). Attaches to Shading group.

5 Volume Shader. Handles rays passing through objects. Attaches to Shading Group (or to Camera for Environment Fog).

6 Geometry shaders. Called prior to rendering for rendering. Attaches to transform node.

7 Displacement shader. Same as Maya, displaces surface geometry. Attaches to Shading Group.

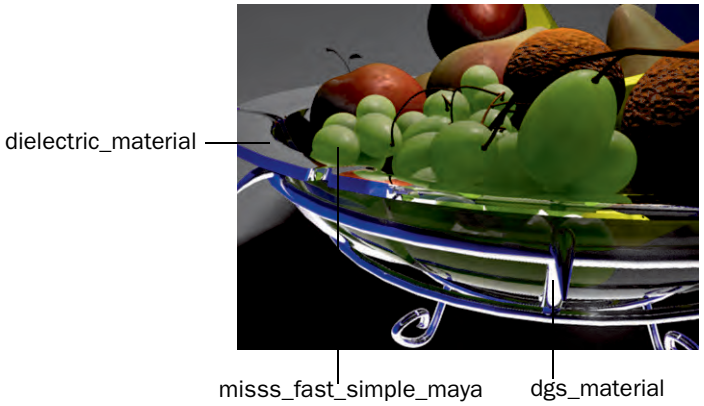
8 Output shader. For post effects (glow, 2D blur, DOF, and so on). Attaches to camera, attaches to multiple shaders, control order of execution.

9 Contour shading. 2 Global shaders, 1 shader on object, attaches to Shading group.

10 Photon / photon volume shaders. Describe how photons are scattered/ absorbed. Not commonly overridden. Attaches to Shading Group.

mental ray for Maya shaders sample workflow

This section describes the sample workflow for three of the mental ray for Maya shaders: dgs_material, dielectric_material, and misss_fast_simple_maya (for subsurface scattering).



dielectric_material node

In this scene, the bowl is created using the dielectric_material shader. This shader is commonly used for dielectric media such as glass, water, and other liquids.

Sample workflow for dielectric_material

1 Open the Hypershade editor. Under the Create tab, select Create mental ray Nodes. Click on dielectric_material under the Materials section to create the shader.

2 In the shader's Attribute Editor, change Ior (Index of Refraction) to 1.65. This is the index of refraction for a typical glass material.

3 Click on the dielectric_material1SG node. In the Attribute Editor, expand the mental ray section. Since photons are used in this scene (for caustics and global illumination, and so on), a photon shader needs to be added to the shader group. Under the Custom Shaders section, click  for the Photon Shader attribute and select dielectric_material_photon (under the Photonic Materials section). This is the corresponding photon shader for the dielectric_material shader.

4 In the Attribute Editor, change the Ior for the dielectric_material_photon to also be 1.65. In this scenario, we wish to simulate both the appearance of glass and the caustic effect of glass. Therefore, the Ior for the dielectric_material and dielectric_material_photon shaders are set to identical values.

dgs_material node

The stand of the bowl is created using the dgs_material shader. This shader is commonly used to simulate glossy materials such as metals, mirrors, glossy paint and plastic, and so on.

Sample workflow for dgs_material

1 Open the Hypershade editor. Under the Create tab, select Create mental ray Nodes. Click on dgs_material under the Materials section to create the shader.

2 Click on the dgs_material1SG node. In the Attribute Editor, expand the mental ray section. Since photons are used in this scene (for caustics and global illumination, and so on), a photon shader needs to be added to the shader group. Under the custom shaders section, click  for the Photon Shader attribute and select dgs_material_photon (under the Photonic Materials section). This is the corresponding photon shader for the dielectric_material shader.

Subsurface scattering node

The grapes in this scene are created using the subsurface scattering node. Subsurface scattering is usually used to create materials that scatter or absorb light internally (rather than reflect light at the surface). Using subsurface scattering, the grapes in the scene appear translucent and glowing.

mental ray for Maya includes several subsurface scattering nodes, for example, misss_physical, misss_fast_shader, misss_skin_specular, and so on.

misss_physical simulates subsurface scattering in the most realistic and physically accurate way. Alternatively, misss_fast_* provides a reasonable simulation of subsurface scattering, but allows for more efficient rendering and is easier to set up.

Sample workflow for misss_fast_simple_maya shader

1 Open the Hypershade editor. Under the Create tab, select Create mental ray Nodes. Click on misss_fast_simple_maya under the Materials section to create the shader.

2 Since subsurface scattering involves the bouncing of light near the surface, a lightmap must be attached to the shader. In the Hypershade editor, click misss_fast_lmap_maya under the Light Maps section to create the lightmap shader.

3 Click on the misss_fast_lmap_maya shader node. In the Attribute Editor, expand the Lightmap Write section and click  for the Lightmap attribute to create a texture node.

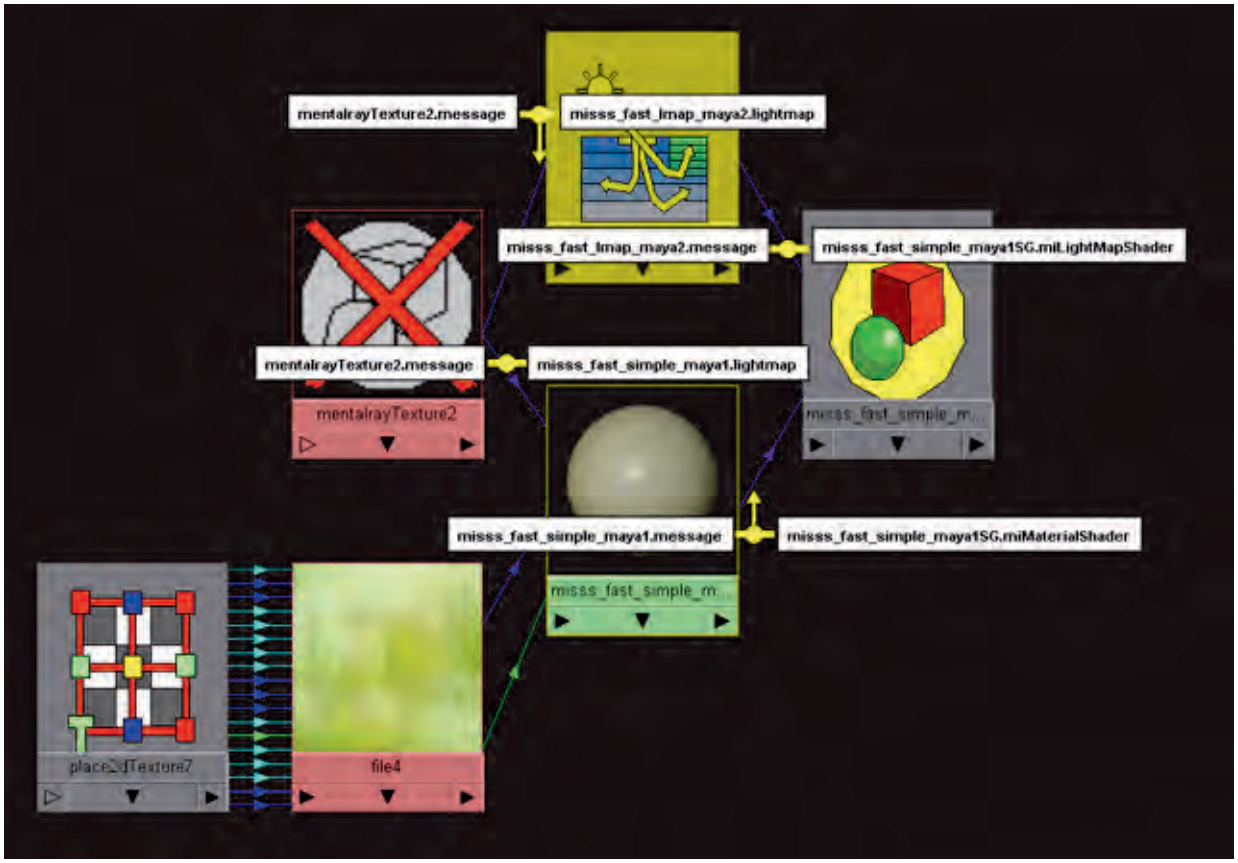
4 In texture node's Attribute Editor, check Writeable. Change the Filter Size Width and Filter Size Height to your render size. Change File Size Depth to 32 bits. Enter a file name in the Image Name attribute.

5 Click on the misss_fast_simple_maya material and map the misss_fast_lmap_maya shader to its Lightmap section.

6 Increase the number of samples in the Lightmap section to create a smoother effect. Increasing the number of samples would create more scattering and increase the intensity of the light gather effect. The scene thus has more glow.

7 Tweak the values under Algorithm control for better results.

Tip Beginning in Maya 8.5, you can also get the look of subsurface scattering in your scene by tuning the scatter attributes available in the mental ray section of the Anisotropic, Blinn, Lambert, OceanShader, Phong and PhongE surface material nodes. For more information regarding these scatter attributes, see "Scattering" on page 111 and "Work with Scattering" on page 119.



Connections for misss_fast_simple_maya shader in Hypershade

Scene settings

1. Caustics should be incorporated in a scene that includes dielectric material. In the Render Settings window (Window > Rendering Editors > Render Settings), select mental ray as your renderer. Under the mental ray tab, select Caustics under Rendering Features to enable the algorithm.
2. To incorporate caustics in the scene, the spotlight in the scene should emit photons. Expand the Caustic and Global Illumination section of the spotlight's Attribute Editor. Check the Emit Photons section.
3. To brighten the scene, increase the Photon Intensity and the Exponent value in the spotlight's attribute editor. If you only increase the photon intensity, this may significantly increase your rendering time. Lowering the exponent value allow you to brighten your caustics without increasing rendering time.
4. If you notice blobby caustics on the walls of your Cornell box, tweak the Filter type and Filter Size sections in your Render Settings window.

Render color per vertex in mental ray for Maya

Render color per vertex in mental ray® for Maya® using the mentalrayVertexColors node. It can be used in a shading network for rendering color per vertex. As a result, you can store shading and lighting information on mesh vertices (rather than shading networks), simplifying your scene and making it more efficient to render.

To use the mentalrayVertexColors node

1. Create color sets. For more information, see “Polygon color sets” in the *Polygonal Modeling* guide.
2. Create a mentalrayVertexColors node. For more information, see ”Create a node” on page 53.
3. In the Connection Editor, load the shape node that contains the color set you want to use into the Outputs column. For more information, see ”Connection Editor” on page 275.
4. Load the mentalrayVertexColors node into the Inputs column of the Connection Editor.
5. Connect the output of the color set (colorSet[n].colorName) to the cpvSets input on the mentalrayVertexColors node.
6. Make connections from the mentalrayVertexColors node out color to the input nodes of a shader, as necessary. For more information, see ”About shading networks” on page 23.

Additional notes

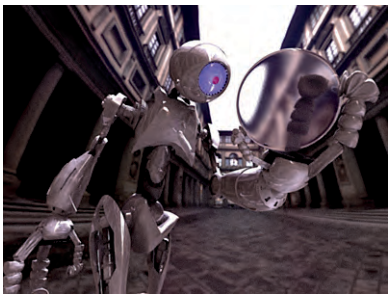
- When a mesh has a connection between the meshShape.colorSet[n].colorName to the mentalrayVertexColors node, the color per vertex data of the mesh is exported as custom data for each vertex. In the case of multiple CPV sets, all of the CPV values are exported.

  If you want to force the export of all the CPV data for all the meshes in your scene, you can turn on the *Export Vertex Colors* attribute in the Render Settings, mental ray tab, Translation section. Exporting CPV data can be process-intensive, so do not turn on this attribute unless necessary.
- Vertex colors are exported as user data for vertices and are accessible from a shader.

Create blurry reflections using mental ray for Maya



Blurry reflections



Blurry refractions (magnifying glass)

(Uffizi Light Probe image courtesy of Paul Debevec (www.debevec.org/Probes)

Raytraced reflections and refractions are typically rendered perfectly sharp, but in the real world, no perfect mirror or transparency exists. Instead, small-scale impurities reflect or refract light slightly, creating a blurry, glossy look. You can now easily render natural looking blurry reflections and refractions with mental ray for Maya.

To render blurry reflections and refractions

1. With mental ray selected as the renderer, turn Raytracing on in the Render Settings window (see "Render Settings window" on page 265 in the *Rendering* guide).
2. In the mental ray tab of the desired material's Attribute Editor, set the reflection and, or refraction blur attributes.

For detailed descriptions of the reflection and, or refraction blur attributes (in the mental ray section of the Shading Group node), see "mental ray" on page 345.

Create lightmaps by baking textures and vertices

Note	When baking light maps using mental ray some of the built-in texture filtering features in Maya can be of great help. For example, when a texture bake operation has been performed, go to the File Texture node in the shader network (by default connected to the outColor channel of the assigned SurfaceShader) and under the Effects tab in the Attribute Editor adjust interactively using the Filter and Filter Offset controls (the Filter Offset control is very sensitive and is effective with values in the 0.05 range) to get the required smoothness. This may then be converted to an unfiltered texture by using the ConvertToFileTexture procedure.

Bake vertices

To bake vertices with mental ray for Maya

1. Select the objects for which you want to bake vertices.
2. Do either of the following:
   - In the Rendering menu set, click Lighting/Shading > Batch Bake > ❒
   - In the Modeling menu set, click Edit Polygons > Color > Polygon Prelight (mental ray) > ❒
3. Adjust any attributes, then click Convert and Close or Convert.

   For a description of the options, see "Lighting/shading > Batch Bake (mental ray) > ❒" on page 246.

Bake textures

To bake a texture

1. Select one or more objects you want to bake.
2. Click Lighting/Shading > Batch Bake (mental ray) > ❒
3. Set any options, then click Convert or Convert and Close.

   For a description of the options, see "Lighting/shading > Batch Bake (mental ray) > ❒" on page 246.

Tip	In texture baking (Occlusion color mode), turning on Final Gather may provide performance benefits.

Bake lightmaps from the command line

To use mental ray baking (to texture) to save a lightmap from the command line

Use the `-r lightmap` flag. For example:

```
Render -r lightmap -rd "C:/output" -sel pSphere1 -sel pSphere2
-override 1 -colorMode 3 -occlusionRays 16
```

The above command bakes both pSphere1 and pSphere2 and saves lightmaps in C:/output.

By default, the texture bake set assigned to each object is used to render the lightmap. In the command above, the bake occlusion is set to 16 occlusion rays. The default values are used for any unspecified texture bake set attributes.

See "Generating lightmaps using the command line" on page 45 for more information.

Create an ambient occlusion map with the Transfer Map tool

To create an ambient occlusion map using the Transfer Map Tool's default settings

Tips	• You can use display layers or quick select sets to separate and keep track of your source and target meshes. • You can use file referencing to bring high resolution geometry into your scene to be used as source meshes.

1. Load your source and target meshes into a new Maya scene.
2. Make sure that your source and target meshes are concentric. Position them on top of each other in the scene view, making sure that their centers are aligned.
3. Select your target mesh in the scene view.
4. Select Lighting/Shading > Transfer Maps.

   The mesh you selected is automatically loaded as a Target and all other meshes in your scene are loaded as Sources.

Tip	By default, all meshes in your scene that are not selected as target meshes are loaded as source meshes. Hide an unused mesh to prevent it from being included as a source mesh.

5. Click on the Ambient icon in the Output Maps section to add an ambient occlusion map.
6. The Ambient occlusion map section appears. In the Ambient occlusion map field, enter the file name for the map (that is, the name of the texture map file as well as the location on disk where the map will be saved).
7. Check the Use mental ray common settings option to create an ambient occlusion map using the default settings. Scroll down to the mental ray Common Output section of the Transfer Map tool. Expand the section and change the following attributes:
   - Fill texture seams.

     It is recommended that this attribute be set to a non-zero value, for example, 1 or 2. See "Fill texture seams" on page 250 for more information regarding this attribute.
8. You can also modify the following options in the Ambient occlusion map section to optimize performance and quality:
   - Occlusion Rays

Tweak this value to improve the quality of your results. Increasing the number of occlusion rays improves quality, but reduces performance speed.

- Occlusion Max Distance

  This option determines the maximum length of an occlusion ray. Rays longer than this value are not considered for occlusion. This option optimizes performance and is off by default.

9 Scroll to the Connect Output Maps section to specify how the texture map you are going to create will be linked to the target mesh. To view the results of the texture map within Maya, select *Connect maps to: New shader / Connect maps to: Assigned shader.*

10 Click the Bake button to bake ambient occlusion map to a low resolution object.

Exclude an object from an occlusion render

New

When using the mib_amb_occlusion shader to perform an occlusion pass, you can choose to exclude one or more objects from the occlusion calculations.

Do one of the following:

Method 1: Hide

Use this method if the object in question does not need to be involved in other trace calls such as reflection and final gather.

In the object's transform node, expand the mental ray section. In the Flags section, disable Derive From Maya and turn on Hide.

Method 2: Adding miLabel

Use this method if the object in question must be involved in other trace calls such as reflection and final gather.

1 Add a mental ray label to all transforms that need to be excluded from the ambient occlusion calculations.

For example, assuming that `$targetTransform` is your transform, set the `miLabel` as follows:

```
addAttr -at short -longName miLabel -defaultValue <your value>
$targetTransform;
```

Note	Set the `miLabel` to a value that is unique to your scene. In other words, select a value that is not currently being used for other mental ray labels in your scene.

2 Set the `id_inclexcl` attribute in the `mib_amb_occlusion` node to the same absolute value as your `miLabel`. For example, if you set your `miLabel` to 8, your `id_inclexcl` value must also be set to -8.

Note	You can set the `id_inclexcl` to either a positive or negative value. Set it to a positive value so that only object instances with a label that matches this number are included in the occlusion render. Set it to negative so that all object instances that match this number are excluded from the occlusion render. For example, if you set your `id_inclexcl` value to 8, then only transforms with a `miLabel` of 8 are included in the occlusion render. If you set your `id_inclexcl` value to -8, however, then all transforms with a `miLabel` of 8 are excluded from the occlusion render.

See the *mental ray for Maya shaders guide* for more information about the `mib_amb_occlusion` node.

Adding a bump map to the mia_material shader

New

To add a bump map to the mia_material shader

1 Create the following nodes: mib_passthrough_bump_map, mib_texture_remap, and mib_bump_basis. You also need to create a texture vector, and it is recommended that you do so by creating the mib_texture_vector node.

2 Connect mib_passthrough_bump_map.message to mia_material.bump.

3 Connect mib_texture_vector.outValue to mib_texture_remap.input.

4 Connect mib_texture_remap.outValue to mib_passthrough_bump_map.coord.

5 Connect mib_bump_basis.u to mib_passthrough_bump_map.u and mib_bump_basis.v to mib_passthrough_bump_map.v.

Advanced mental ray for Maya shading

Use a custom-made mental ray for Maya shader in Maya

To use custom-made mental ray for Maya shaders in Maya

Tip	mental ray user data is now supported in Maya. Declared (with parameters), and Literal (raw bytes) data are translated as two separate nodes in Maya. This applies only to mental ray for Maya custom shader nodes.

1. Write or obtain a shader declaration file (that is, an .mi file that contains the description of the shader(s)).

   See ”Write a shader declaration file” on page 193.

2. Insert the shader into a shader library (.dll on Windows, and .so on Linux, Apple® Mac®).
   - *Maya8.5/mentalray/lib* contains shader libraries compiled and loaded into Maya by default.
   - Compiling and linking a shader on Windows requires to include `shader.h` and link to `shader.lib`. These two files are shipped with maya, and can be found at *Maya8.5/devkit/mentalray*.

   For more information on shader libraries, see ”mental ray for Maya custom shaders” on page 162.

3. Edit the `maya.rayc` file to link the shader declaration file to it, so that Maya can use mental ray for Maya to render the shader.

Note	Editing the `maya.rayrc` file is optional. By default, mental ray for Maya looks for shader libraries in the default install directory: `...\Autodesk\Maya8.5\mentalray` If your shader libraries are not located in the default directory, you must use the `maya.rayrc` file so that Maya can see your shaders. See, ”Edit the maya.rayrc file” on page 193.

4. Load the shader by doing one of the following

   See ”Load shaders” on page 195.

Note	Compiling and linking a shader on NT requires to include "shader.h" and link to "shader.lib". These two files are shipped with maya, and can be found at *Maya8.5/mentalray/devkit*.

Write a shader declaration file

For an example of how to write shader header and source code, see *Maya8.5/devkit/mentalray*. *Maya8.5/mentalray/include* contains *base.mi*, *contour.mi* and *physics.mi* that declares basic shaders.

As a part of devkit, Microsoft Visual Studio project files are shipped. You can open *base.dsw*, *contour.dsw*, *physics.dsw* and compile them yourself.

If *apply* is not provided in the shader declaration, you will find the shader node in *Miscellaneous* section of the Create Render Node window (or bar in the Hypershade).

To place the node into a different category, use the *apply* keyword in the shader declaration. For example, for *mib_texture_vector* (*base.mi*). *mib_texture_vector* node is under *Textures* section:

```
declare shader
   vector "mib_texture_vector" (
      integer      "select",
            integer      "selspace",
      integer      "vertex",
      integer      "project"
   )
   version 2
   *apply texture*
end declare
```

Note For some categories not supported by the *apply* flag (contour, for example), we provide a mel script:
`mentalrayCustomNodeClass.mel`
Please refer to the comment in the file for further detail.

Click your shader node. The shader has blank icon and the *Script Editor* will have a warning message, unless you provided *render_myshader.xpm*.

Check out the *Attribute Editor* of the shader. If the shader had any parameters, you should be able to see corresponding fields in the *Attribute Editor*.

You can create your own Attribute Editor Template file to provide better look of the attribute editor.

If the shader is called *myShader*, create a file called *AEmyShaderTemplate.mel*, and place it in Maya8.5/scripts/AETemplates.

Edit the maya.rayrc file

Editing the `maya.rayrc` file is optional. By default, mental ray for Maya looks for shader libraries in the default install directory.

Windows:

`...\Autodesk\Maya8.5\mentalray`

Mac:

`.../Applications/Autodesk/maya8.5/Maya.app/Contents/mentalray`

Linux:

`.../usr/autodesk/maya8.5/mentalray`

If your shader libraries are not located in the default directory, you must use the `maya.rayrc` file so that Maya can see your shaders. In this case, edit this file for every shader that is to be rendered by mental ray for Maya; it allows Maya to see the shader.

Editing the `maya.rayrc` requires you to restart Maya. Alternatively, you can type the following in the script editor (see Mayatomr MEL documentation for more details):

```
Mayatomr -updateRayrc
```

To edit the maya.rayrc file

The following is an example of how to edit the `maya.rayrc` file.

Assuming the declaration file is `myshader.mi` and the shader file is `myshader.dll/so`, do the following:

```
      mi "MI_FILE_DIRECTORY/myshader.mi"
      link "SHADER_FILE_DIRECTORY/myshader.{DSO}"
```

An example of `maya.rayrc`:

```
      registry "{MAYABASE}"   value   "C:/Program Files/Autodesk/
Maya8.5/mentalray" end registry

      registry "{SYSTEM}"   value   "windows"      end registry
      registry "{DSO}"   value   "dll"      end registry

      $lookup "{MAYABASE}"
      $lookup "{SYSTEM}"
      $lookup "{DSO}"

      registry "{MRMAYA_START}"
         link "C:/myshader/Release/myshader.{DSO}"
         mi   "C:/myshader/include/myshader.mi"
         echo   "mental ray for Maya - startup done"
      end registry

      $lookup   "{MRMAYA_START}"
```

Load shaders

To import a custom shader library

1. Copy the declaration file to the `include` directory of your mental ray for Maya installation.
2. Copy the library file into the `lib` directory of your mental ray for Maya installation.
3. Modify the configuration file `maya.rayrc` in the plug-ins directory of your Maya installation. Add statements to include the declaration file and to link with the library file.

Note Editing the `maya.rayrc` file is optional. By default, mental ray for Maya looks for shader libraries in the default install directory:

`...\Autodesk\Maya8.5\mentalray`

If your shader libraries are not located in the default directory, you must use the `maya.rayrc` file so that Maya can see your shaders. See, "Edit the maya.rayrc file" on page 193.

mental ray for Maya is able to load and render with your custom shader library. Placing the declaration file in the include directory also uses mental ray for Maya to parse the file and create new Maya node types that correspond to the shaders declared in the library.

With the mental ray Shader Manager

The *Shader Manager* lets you interactively load and unload mental ray shader libraries and work with them during a Maya session. (You do not need to shut down first, and you do not need to set the environment variable `MI_CUSTOM_SHADER_PATH`.)

You can select from a list of `.mi` library files that contain the mental ray shader declarations. The shaders contained in the selected `.mi` library files automatically appear in Hypershade, just like the Maya and mental ray for Maya base shader nodes. mental ray for Maya base shaders are now fully integrated into Hypershade and Create Render Node panel.

(You do not need to set the environment variable `MAYA_MRFM_SHOW_CUSTOM_SHADERS` to show custom shaders in Hypershade.)

Note Though you can dynamically load/unload shaders in render time, those shaders that are used should be specified in the `maya.rayrc` file.

The `maya.rayrc` file requires both `.mi` and, or `.so` of the desired libraries to be included.

To load or unload custom mental ray shaders

1. Select Window > Rendering Editors > mental ray > Shader Manager.

   The Shader Manager opens and shows which declaration files are loaded.

2. Click to load or unload a declaration file, auto load the file, or get information on the file. For descriptions of the buttons and options in the mental ray Shader Manager window, see "Window > Rendering Editors > mental ray > Shader Manager" on page 243.

With the MI_CUSTOM_SHADER_PATH environment variable

You need to add your `.mi` file to this environment variable path (unless you use the Shader manager) to load any shader that is to be rendered mental ray for Maya.

This variable tells mental ray for maya a directory where `.mi` files are located. Every .mi file located in MI_CUSTOM_SHADER_PATH will be parsed on plug-in load.

This environment variable should be set prior to loading the plug-in. mental ray for Maya interprets this variable in different ways. If it is not empty but does not point to an existing file or directory, a file dialog opens up as the mental ray for Maya plug-in is (auto-)loaded. A .mi file should be selected that contains mental ray shader/phenomenon declarations which the Factory should create Maya node types for. The file dialog comes up again in a loop to allow more than one .mi file to be loaded. It stops when the Cancel button has been pressed.

If the Factory should load all required files automatically, then a file or a directory containing .mi files should be given in the environment variable. For loading a single file, set MI_CUSTOM_SHADER_PATH as follows:

- Linux®

  ```
  setenv MI_CUSTOM_SHADER_PATH /usr/local//autodesk/Maya8.5/
  include/base.mi
  ```

- Windows

  ```
  set MI_CUSTOM_SHADER_PATH=C:/Program Files/Autodesk/Maya8.5/
  mentalray/include/base.mi
  ```

For parsing all files in a directory, you could use (in which no file dialog will appear) the following:

- Unix®

  ```
  setenv MI_CUSTOM_SHADER_PATH /usr/local/mi/rayinc31
  ```

- Windows

  ```
  set MI_CUSTOM_SHADER_PATH=c:/usr/local/mi/rayinc31
  ```

The default value of *MI_CUSTOM_SHADER_PATH* is *Maya8.5/mentalray/include*.

You can modify *Maya.env* to add your own directory to the path. For example, the following line in *Maya.env* will append *C:\myshader\include* to the path :

```
MI_CUSTOM_SHADER_PATH = C:\myshader\include
```

To make your shader be loaded by default, you can either add the directory to the path, or put the file in the path.

While mental ray plug-in is loaded, *base.mi*, *contour.mi* and *physics.mi* are parsed, nodes for each shader declared in the `.mi` files will be created. See the *Script Editor* for nodes being created.

Same for your shader. If the `.mi` file is in MI_CUSTOM_SHADER_PATH, you should be able to find your shader name in the *Script Editor*. For example, my *Script Editor* has following lines (if optionVar miFactoryVerbosity is set to 4 or higher. (*myshader1* and *myshader2* are declared in *myshader.mi*)

```
// generating nodes ...
// parsing C:/myshader/include/myshader.mi
// myshader1
// myshader2
```

Relate Maya custom shaders to mental ray for Maya custom shaders

Custom shaders written for Maya's Software renderer can be translated to equivalent mental ray for Maya custom shaders. This way, two shaders are required (one custom Maya plug-in shader and one mental ray custom shader) but only one shading network is necessary.

In previous versions of Maya, you must create two separate shading networks, one with Maya's plug-in shader and the other with mental ray custom shader. Beginning Maya 7.0, you only need to make one shading network with the Maya plug-in shader, and mental ray for Maya will automatically translate the connection to the corresponding mental ray shader during processing.

Tip

- The mental ray shader must have the same name as the Maya plug-in shader.
- If the mental ray shader is loaded first, then you must create a special attribute to the mental ray shader to indicate that this shader corresponds to a Maya plug-in shader.

To relate a Maya custom shader with a mental ray for Maya custom shader

1. The mental ray shader and its .mi file declaration must have a name matching the custom Maya shader node. For more information, see "Write a shader declaration file" on page 193.
2. Load the .mi declaration for your custom mental ray for Maya shader in the Shader Manager (if you have not already loaded it). For more information, see "Window > Rendering Editors > mental ray > Shader Manager" on page 243 and "Load shaders" on page 195

mental ray for Maya automatically detects that a custom Maya shader has the same name as the new mental ray shader. When rendering, it will use the mental ray shader as appropriate.

Specify light parameters

Light parameters are message attributes. Connect any output attribute of a light node (not the shape node) to, for example, the desired element of a light array of your custom material shader.

These extensions should enable you to create pretty much any shading network supported by mental ray. It can be either exported to a file or rendered from within Maya. Some restrictions apply:

- Cooperation between proprietary mental ray shaders and the Maya base shader library is not always seamlessly possible. Although much work has been put into making the Maya base shaders compatible with standard mental ray shaders, some restrictions still apply. Custom shaders might thus have to be designed in a special way, if cooperation between the Maya base shader library and custom shaders is desired.
- The mental ray Phenomenizer represents a shader declaration, not a definition. Therefore, it cannot be directly linked into a shading network.

Work with phenomenon

Build phenomena

To build a phenomenon

1. In Hypershade, build a shading network normally with mental ray for Maya base shaders or any custom shaders.
2. Add a phenomenon node to the Work Space.

   This is the root node for the phenomenon.
3. Middle mouse drag from the node that has the look you want to capture in the phenomenon (for example, the final node that plugs into the Shading Network's Shading Group) to the Phenomenon root, then select Other.
4. The Connection Editor appears.
5. Connect one of the following to the root:
   - For materials, connect the outcolor.
   - For geometry, connect the meshout .
   - For volume, connect the outvalue.
6. Add an attribute for the Phenomenon node by middle mouse dragging from the root to a node in the Shading Network, then selecting Other.

   The Connection Editor appears.

Connect Interface to whatever attributes you want to make available on the Phenomenon for adjustments.

7 Repeat for any other nodes whose attributes you want to make available for adjustments.

8 Do the following:

- Specify version (optional).
- Apply flags for the type (optional).
- Apply global flags (optional).

9 Select the entire Shading Network, including the Phenomenon root.

10 Select File > Export Selection > ❐.

The Export Selection Options window appears.

11 Select mental ray from the File Type drop-down list.

12 Turn on Export Selected Items only.

13 Select *Shaders, Phenomena, Materials* from the Predefined Export Filters.

14 Save to your project's mental ray directory.

Use a phenomenon in a scene

To use a phenomenon in a scene, you must load the phenomenon with the Shader Manager.

After the Phenomenon is loaded, you can find it in the Miscellaneous section of the Create Render Node window, unless you set the Apply flag, in which case, you'd find it in the appropriate section. (See "Write a shader declaration file" on page 193 for more information on the Apply flag.)

Work with custom mental ray text

Assign custom text to an object or shader

For more information about the Custom mental ray text, see "Custom mental ray text" on page 171.

To assign a material shader (example)

1 Create a new scene.

2 Create a NURBS object.

3 Assign a new Blinn node to the NURBS object.

4 Select the Blinn node (either in the Attribute Editor, the Hypergraph, or the Hypershade).

5 Select Window > Rendering Editors > mental ray > Custom Text Editor.

The Custom Text Editor opens. For a description, see ”mental ray Custom text editor” on page 275.

When selecting objects or shaders in Maya the editor is updated according to the selected entity and enable the appropriate control if the current selection allows creation and assignment of custom mi text.

6 Click the new button in the Custom Text Editor.

The Attribute Editor displays the custom text user interface.

7 Enter some text and click Apply.

Any valid mi text can be entered and is stored once Apply is selected. Selecting Clear deletes the current text from the node and clears the text field.

The custom text can make use of special placeholder characters or strings that are recognized during translation. They are replaced by actual values on export. Right now, there is just one such variable supported: the at sign (@) is a placeholder for the current frame number.

8 Select a Custom Text Mode to specify if this text should be appended, prefixed to or completely replace the corresponding entity in the mi.

9 Select the name in the Attribute Editor, for example mentalrayText1, and type *myMaterial*.

After applying the text you should rename the node to some descriptive identifier, perhaps including a hint about the mode of application. Especially the shader text nodes should get a name that mentions their intended use because the Custom Shader Text section gathers all light, camera, material, and shader text nodes into one menu.

10 Select the Blinn node again.

The text editor shows the new entry myMaterial.

11 Select File > Export All and export the scene to a mental ray (mi) file.

Assign text to entities

For more information about the Custom mental ray text, see ”Custom mental ray text” on page 171.

Click the button in the Custom Text Editor to create a custom text node and assign it to the selected node in the scene. The Attribute Editor is updated.

The option menu lists all the available text nodes that were previously created. By selecting a new entry in this option menu the text assignment of the current scene entity is replaced with this newly chosen text node. Saving the scene to a Maya file also stores all the existing text nodes, both connected and unconnected. Custom text nodes have to be deleted by standard Maya methods, as the Custom Text Editor doesn't provide a way to do it.

For more information on the different types of text assignments refer to ”Types of text assignments” on page 172.

mental ray for Maya dynamic attributes

Dynamic attributes for mental ray custom shaders

For information on dynamic attributes for mental ray custom shaders, see ”Dynamic Attributes” on page 196 in the *Rendering* guide.

How Do I? mental ray for Maya shaders

Troubleshoot crash or render abort

mental ray for Maya expects only certain connections to be made to the message attribute in the Attribute Editor. See ”mental ray Shader connections” on page 155 for more details.

Troubleshoot node factory errors in Script Editor

The Node Factory prints progress and error messages to the Script Editor. If Maya was unable to create a node (that is, a node seems to be missing) or an attribute on a node, a parsing error may have occurred and an error message is printed.

The reason for such errors are usually name clashes.

Troubleshoot error messages

PHEN 0.2 error 051011: shader "myShader" not found : missing link statement

Make sure the `maya.rayrc` has a proper link statement for myShader.

API 0.0 error 301031:Call to undeclared function "myShader"

Ensure the following:

- The `maya.rayrc` has a proper mi statement for myShader.
- Shader files don’t have a `.cpp` extension. A shader written in C++ is not recognized correctly.

API 0.0 error 301032: while defining "": undefined shader "myShader"

Ensure the following:

- The `maya.rayrc` has a proper mi statement for myShader.
- Shader files don't have a `.cpp` extension. A shader written in C++ is not recognized correctly.

Troubleshoot cannot find main function

Did you choose *Win32 Dynamic-Link Library* when starting a new project?

Troubleshoot cannot open input file "shader.lib"

Make sure the library path is valid. There is be no space between */libpath:* and the path name.

mental ray for Maya transfer maps

Troubleshoot Transfer Maps search envelope produces unexpected results

If you are generating a mental ray Ambient occlusion or Custom map, the normal direction that you choose (under the mental ray Common Output section) affects the results of your search method. The target surface's normals determine what is inside of a search envelope - the inverse of the normal is what is inside the search envelope. Therefore, if you reverse the normal direction, the search results are also reversed.

Troubleshoot ambient occlusion transfer map appears grainy with lost details

Increase the number of occlusion rays to adjust the quality of your ambient occlusion map. If the problem remains, create a custom map in the Transfer Map Tool (Lighting/Shading > Transfer Map) and connect to it the mib_fg_occlusion shader. Ensure that Trace is turned off for all target meshes; otherwise, they may occlude the source meshes. (Open the Attribute Editor for the object's transform node and expand the mental ray section. Under the Flags section, select No for Trace.) Adjust the final gather quality via the Render Settings: mental ray tab.

The most important attribute for improving the detailing is the Max radius. A smaller Max radius value produces better details.

Troubleshoot mental ray for Maya aborts rendering when using normal maps

mental ray does not support `DDS` files or `LZW` compressed `.tif` files.

If you create a normal map using the Transfer Maps tool and select `tif` as your file format, Maya will create the `.tif` file with a `LZW` compression. mental ray does not support the use of `LZW` compressed `.tif` files. and an error occurs as follows:

```
// Error: (Mayatomr.Output) : while defining texture "file1:tex":
failed to open texture file C:/temp/sampledNormals.tif
```

Choose a different file format for your normal map. The `EXR` file format is recommended. If you encounter this error, you must also restart Maya to render with mental ray again.

Atmospheric effects in mental ray for Maya

Troubleshoot volumetric fog with depth map shadows

If the fog appears with streaks, or the entire effect disappears from your scene when rendering in mental ray for Maya, you can use one of the following solutions.

Solution 1

Use ray traced shadows instead of depth map shadows. See “Render raytraced shadows” in the *Lighting* guide.

Solution 2

1. In the Attribute Editor for the volume primitive shape node, turn on Volume Samples Override.
2. Set the Volume Samples value to 5, or greater (between 5 - 20 is recommended). (You may need to tune this setting repeatedly, until you achieve a good result.)
3. Turn on Depth Jitter.
4. Render your scene.

Baking textures in mental ray for Maya

Troubleshoot 32 bit TIFF and IFF images are black

If you view 32 bit TIFF or IFF images in FCheck and they are black and contain no color information, use the mental ray Image Display (`imf_disp`) utility to view them. The `imf_disp` utility is located in the Maya8.5/bin/imf_disp directory. For more information on how to use the utility, see the *mental ray User Manual* available from the Maya Help.

Troubleshoot baking quality with final gather

Updated

When trying to remove hard lines and artifacting and improve general occlusion accuracy, the recommended workflow is to turn on Final Gather in the Render Settings window (see "Render Settings: mental ray tab" on page 290 in the *Rendering* guide). Once Final Gather is turned on, the Occlusion Rays and the Occlusion Falloff attributes (in the Lighting/shading > Batch Bake (mental ray) options dialog box) do not contribute to your bake.

To improve baking quality, use the Final Gather Quality and Final Gather Reflect attributes in the Texture Bake Set node. In addition, you can also tweak the Final Gathering attributes in the Render Settings: mental ray tab. In particular, you may need to tune Accuracy and Point Interpolation, while Point Density has no effect on baking.

8 Render node utilities

About

Render node utilities

Maya provides various render node utilities that let you expand the functionality of or obtain information about the way in which some rendering nodes are used.

General utilities

Maya's General utilities are used to add detail and create interesting effects for textures.

For a description of each of the general utilities and what you can use them for, see "About General Utilities" on page 472.

To use general utilities, see:

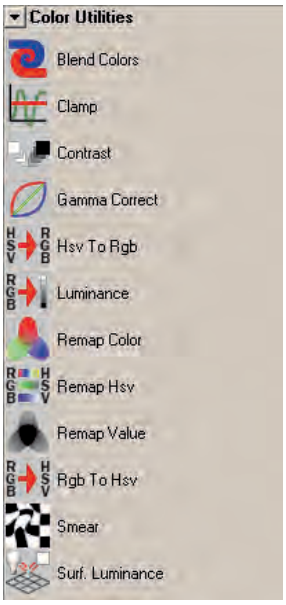
	”Use the Array Mapper utility” on page 208
	”Use the Bump 2d utility” on page 208
	”Use the Bump 3d utility” on page 210
	”Use the Condition utility” on page 211
	”Use the Distance Between utility” on page 211
	”Use the Height Field utility” on page 212
	”Use the Light Info utility” on page 212
	”Use the Multiply Divide utility” on page 213
	”Use the 2d Placement utility” on page 213
	”Use the 3d Placement utility” on page 214
	”Use the Plus Minus Average utility” on page 215
	”Use the Projection utility” on page 215
	”Use the Reverse utility” on page 215
	”Use the Sampler Info utility” on page 216
	”Use the Set Range utility” on page 218
	”Use the Stencil utility” on page 219
	”Use the Studio Clear Coat utility” on page 220
	”Uv Chooser” on page 497
	”Use the Vector Product utility” on page 220

Color utilities

You can expand, enhance, or manipulate colors in applied textures using the Color utilities. For example, you can blend colors, adjust contrast, and convert HSV to RGB.

For a description of each of the color utilities and what you can use them for, see ”About Color Utilities” on page 499.

To use switch utilities, see:

	”Use the Blend Colors utility” on page 221
	”Use the Clamp colors utility” on page 223
	”Use the Contrast utility” on page 224
	”Use the Gamma Correct utility” on page 224
	”Use the Hsv to Rgb utility” on page 225
	”Use the Luminance utility” on page 225
	”Use the Remap Color, Remap Hsv, or Remap Value utilities” on page 226
	”Use the Rgb to Hsv utility” on page 226
	”Use the Smear utility” on page 227
	”Use the Surf. Luminance utility” on page 227

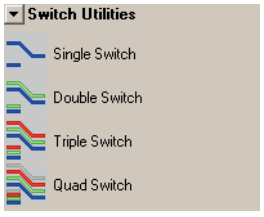
Switch utilities

Switch utilities let you apply textures, or parts of textures to different patches that make up one object.

Several objects can share shading characteristics and you can define unique characteristics on an object-by-object basis using Maya’s Switch utilities.

For a description of each of the switch utilities and what you can use them for, see ”About Switch Utilities” on page 505.

To use Switch utilities, see:

	”Use the Single Switch utility” on page 227
	”Use the Double Switch utility” on page 230
	”Use the Triple Switch utility” on page 232
	”Use the Quad Switch utility” on page 235

Note	For StudioPaint users: It is common to use Switch utilities when textures have been imported from StudioPaint since each surface has an individual texture assigned to it, but surfaces are in the same shading group.

Particle utilities

For information, see "Overview of particles" on page 21 in the *Dynamics* guide.

Image planes

Image planes are attached to cameras. For information on image planes, see "Create, edit, or position an image plane" on page 127.

Glow

For information on the Optical FX Glow utility, see "Optical FX Attributes" on page 156 in the *Lighting* guide.

How do I? Use General utilities

Use the Array Mapper utility

For a description of the Array Mapper utility, see "Array Mapper" on page 473.

Use the Bump 2d utility

For a description of the Bump 2D utility, see "Bump 2d" on page 473.

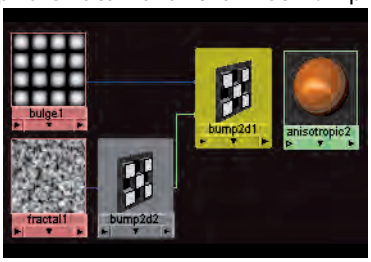
To bump map layered textures using Provide3d Info

1. Map a 2D texture to a material's Bump Mapping attribute.
2. Map a 3D texture to one of the 2D texture's Color attributes (such as V Color).
3. Double-click the bump2d swatch in the Hypershade to open the bump2d's Attribute Editor and turn Provide3d Info on. Maya bump maps both textures.



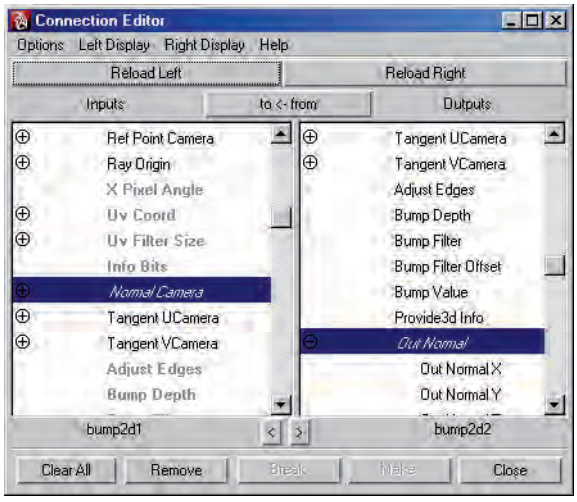
To cascade, or stack, bump maps

1. In the Hypershade, create two 2D textures and a material.
2. Create a Bump2d utility node.
3. Middle-drag the first 2D texture swatch over the Bump2d utility swatch.
4. Create another Bump2d node and middle-drag the second 2D texture swatch over the new Bump2d utility swatch.
5. Middle-drag this Bump2d swatch over the first Bump2d swatch.

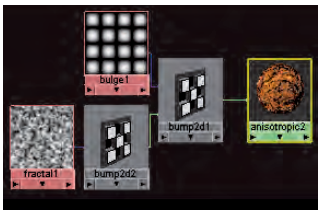


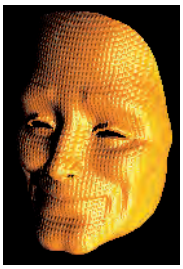
The Connection Editor appears.

6. From the Right Display menu, select Show Hidden.
7. From the Left Display menu, select Show Hidden.
8. Select Out Normal from the Outputs column and the Normal Camera from the Inputs column.



9 In Hypershade, middle-drag the first Bump2d utility swatch over the material swatch to assign both bump maps to a material's attribute.





Bulge bump map.



Fractal bump map.



Bulge + Fractal bump maps.

Tip	If you bump-map a material that uses environment maps, connect the Out Normal attribute of the bump node to the Normal Camera attribute of the Environment texture, as well as to the Normal Camera attribute of the material. Otherwise, the environment does not reflect correctly in bumpy areas. Maya provides a MEL script that does this for you. After you connect the Out Color of the environment map to the Reflected Color of the material, type `cnctBumpProjNormal` *`shader-name`* in the command line (where *shader-name* is the name of the material).

To delete a bump2d map

1. Open the material's Attribute Editor.
2. Right-click the word Bump Mapping.
3. Select Break Connection from the pop-up menu.

Use the Bump 3d utility

For a description of the Bump 3D utility, see "Bump 3d" on page 475.

To delete a bump3d map

1. Open the material's Attribute Editor.
2. Right-click the word Bump Mapping.
3. Select Break Connection from the pop-up menu.

Use the Clear Coat utility

For a description of the Clear Coat utility, see "Clear Coat" on page 475.

To create a clearCoat node

1. First load clearcoat using the Plug-in Manager (Window > Settings/ Preferences > Plug-in Manager).
2. Open the Hypershade (Window > Rendering Editors > Hypershade).
3. From the Hypershade, select Create > General Utilities > Clear Coat. (Close then re-open the Hypershade or the Create Render Node window, if open, to see the plug-in.)

   Middle-drag the Clear Coat swatch to create new clearCoat nodes.

Use the Condition utility

For a description of the Condition utility, see "Condition" on page 475.

To map the Condition utility to four textures (example)

Create a material, assign it to an object, then map the Condition utility to the material's Color attribute. Adjust the material's attributes if necessary.

In the Condition's Attribute Editor, set the following:

- Map a texture to First Term. This texture represents the Second Term's texture coverage.
- Map a texture to Second Term. This texture represents the pattern of the coverage.
- Map a texture to Color If True. This texture represents the surface color.
- Map a texture to Color If False. This texture represents the color of the overlying texture.

- Change the attributes for each texture and use the texture placement object to adjust the texture on the object if necessary.
- Use the Operation drop-down list items to see the transition between textures.

Tip	Set the Operation option to Greater Than or Less Than to see the combined results.

Use the Distance Between utility

For a description of the Distance Between utility, see "Distance Between" on page 477.

To use the Distance Between utility

1. Create two locators in your scene and position them as you want to use them for the Distance Between utility node.

2 Create the Distance Between utility node (from the Hypershade, select Create > General Utilities > Distance Between).

3 Connect the locators to the Point1 and Point2 attributes of the Distance Between locators.

4 Connect an attribute from the material or texture node to the Distance Between utility node.

The distance between the locators controls how the attribute on the material or texture appears.

Use the Height Field utility

For a description of the Height Field utility, see "Height Field" on page 478.

To use the Height Field utility

1 Create the Height Field utility node (from the Hypershade select Create > General Utilities > Height Field).

A plane is created. Scale it if desired.

2 Create a texture and map it to the Height Field utility node's displacement.

3 Adjust the displacement of the plane by adjusting the texture's Alpha Gain value.

To improve the appearance of the shading press 6. You can also set the resolution that the Height Field utility uses. It can only display Surface textures or the Ocean Shader.

Use the Light Info utility

For a description of the Light Info utility, see "Light Info" on page 479.

To view and connect Light Data attributes to Light Info attributes

1 Once you have created lights in the scene, select Lights from the Hypershade menu bar to view the LightShape swatches in Hypershade.

2 Select Light Info from the Create > General Utilities menu.

3 Ctrl+middle+drag the LightShape swatch over the Light Info swatch. The Connection Editor appears.

4 In the light's column, make sure Show Readable is on in the Filter menu. In the Light Info column, make sure Show Inputs only is on.

5 Click to connect the LightShape's World Matrix [0] attribute to the World Matrix attribute of the Light Info node.

Notice the light tab added to the top of the Light Info's Attribute Editor. Click this tab to access the light's information and adjust these values to translate and change the light in X, Y, and Z.

You can also select any one of the Light Data attributes from the Connection Editor. Light Data attributes include the light direction, light intensity, light ambient, light diffuse, light specular, and light shadow fraction.

6 Select the attribute you want to connect from the list.

Use this information as the input to other shading nodes to produce interesting effects. For example, if you connect the Sample Distance attribute to one of the color attributes of a material, the color changes depending on how far it is from the light.

Note You can attach the World Matrix of any object (not just a light) to this node, to get information about the object's position relative to the point being shaded.

Use the Multiply Divide utility

For a description of the Multiply Divide utility, see "Multiply Divide" on page 481.

To multiply and divide input attributes

1 In a material's Attribute Editor, map the Multiply Divide utility to the Color attribute.

2 In the Multiply Divide Attribute Editor, map textures to the input attributes. Click the boxes next to Input 1 and Input 2 to and select textures from the Create Render Node window.

3 Click the Input 1 and 2 boxes to access the Attribute Editors for the mapped textures and change the attribute settings if necessary.

Tip To return the focus to the Multiply Divide Attribute Editor, either click the Focus button in the texture's Attribute Editor until you access it, or click the Multiply Divide swatch in the Hypershade panel.

Use the 2d Placement utility

For a description of the 2d Placement utility, see "2d Placement" on page 483.

You can reposition 2D textures with numerical precision in the place2dTexture node's Attribute Editor, or you can use Maya's Texture Placement Tool to reposition textures or labels interactively.

To position a 2D texture interactively

1 In the Hypershade, click the place2dTexture swatch that is connected to the texture you want to reposition.

The place2dTexture's Attribute Editor appears

Tip If you cannot see the place2dTexture swatch, do the following:

- Select the texture swatch, then click the Input Connections button on the Hypershade toolbar.
- If no place2dTexture swatch exists, it has been deleted or not created (because it's automatic creation has been turned off by default). You must add one (see "Create a node" on page 53), then connect it to the texture (see "Connect render nodes using their default connections" on page 61) before you can reposition it.

2 Do one of the following:

- Change the values of the attributes in the Attribute Editor. For detailed descriptions of the attributes, see "2d Placement" on page 483.
- For NURBS, click the Interactive Placement button in the Attribute Editor to use the Texture Placement tool. To set the Texture placement tool, see "Texture placement vs. label mapping" on page 39.

Tip It may be difficult to place a texture using only the manipulator. Use both the manipulator and the Attribute Editor to get the desired result.

Use the 3d Placement utility

For a description of the 3d Placement utility, see "3d Placement" on page 485.

To use the 3D placement manipulator

1 Assign a 3D texture to a surface.

The texture's place3dTexture node (swatch) appears in Hypershade and a manipulator appears in the view panel.

2 Double-click the node to open the Attribute Editor.

3 Select the Interactive placement (see "Interactive Placement" on page 487) to reposition the 3d texture to show the placement manipulator. (This tool similar to a combined version of the move, scale, and rotate tool.)

To use the Fit to group bbox option

1 Assign a 3D texture to a surface.

The texture's place3dTexture node (swatch) appears in Hypershade and a manipulator appears in the view panel.

2 Double-click the node to open the Attribute Editor.

Select the Fit to group bbox to reposition the 3d texture. This causes the 3D texture to be scaled, moved, rotated as necessary to the assigned object's bounding box.

Use the Plus Minus Average utility

For a description of the Plus Minus Average utility, see "Plus Minus Average" on page 486.

You can make several connections to the same attribute using Plus Minus Average based on a number. The last part of the attribute name has a number within square brackets.

Input3D[0] designates the first connection to the Input3D attribute, Input3D[1] designates the second connection to this attribute, Input3D[2] designates the third connection to this attribute, and so on. The first connection is always assigned a 0. Each connection gets its own ID number. For example, the OutColor of Stucco consists of one group of three values that you can connect to the Input3D values, not the Input 2D values or Input1D values.

Tip	You can rearrange connections to a higher or a lower number without interfering with the other connections in the list, and you can break connections as you would any connection.

Use the Projection utility

For a description of the Projection utility, see "Projection" on page 487.

To map a Projection utility node to a texture

1. Create a Projection utility node.
2. In the Projection node's Attribute Editor, map a texture to the Image attribute.
3. Adjust the texture attributes if necessary, then create a material.
4. Middle-drag the Projection swatch over the material swatch and select an attribute from the pop-up menu, such as Color.

   You can now use the Projection Attributes (next) to adjust the texture placement on the surface.

Use the Reverse utility

For a description of the Reverse utility, see "Reverse" on page 492.

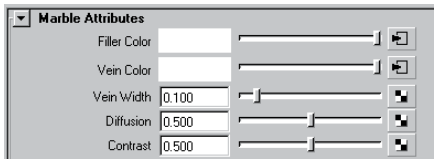
In the following, the color of a Marble texture is reversed. This means that 0.9 is subtracted from 1, making the color value 0.1. The result can be expressed as in the following formula:

```
Output = 1 - Input
```

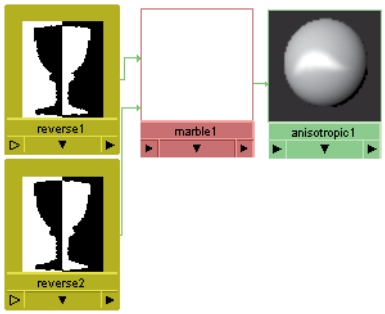
You can enter values for Input to get the effect you want in the Attribute Editor. Reverse outputs and accepts single-component values, two-component values, and all three-component values.

To reverse attributes

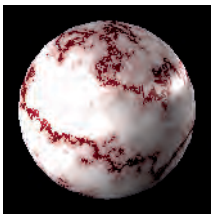
1. Map a texture to a material's attribute, such as Color.
2. In the texture's Attribute Editor, map Reverse to the attribute you want to reverse.



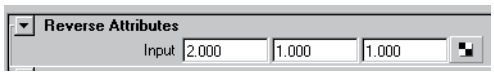
In this example, Reverse is mapped to the Marble texture's Filler and Vein colors.



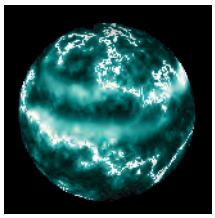
3. Following the above example, in the Marble texture's Attribute Editor, click the box next to Filler Color to open the Reverse Attribute Editor and change the Input attribute values as necessary. The following shows the results.



Before Reverse.



Change these values.



After Reverse.

Use the Sampler Info utility

For a description of the Sampler Info utility, see "Sampler Info" on page 493.

To use the Sampler Info utility

Once you have created and assigned a material and texture to an object, create a Sampler Info utility node.

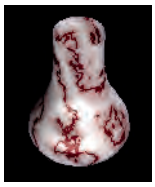
1. Middle-drag the Sampler Info swatch over the texture swatch.

   The Connection Editor appears.
2. Connect a Sampler Info node to any available texture attribute.

3 In the Sampler Info Attribute Editor, change the values for the connections to get the desired results.

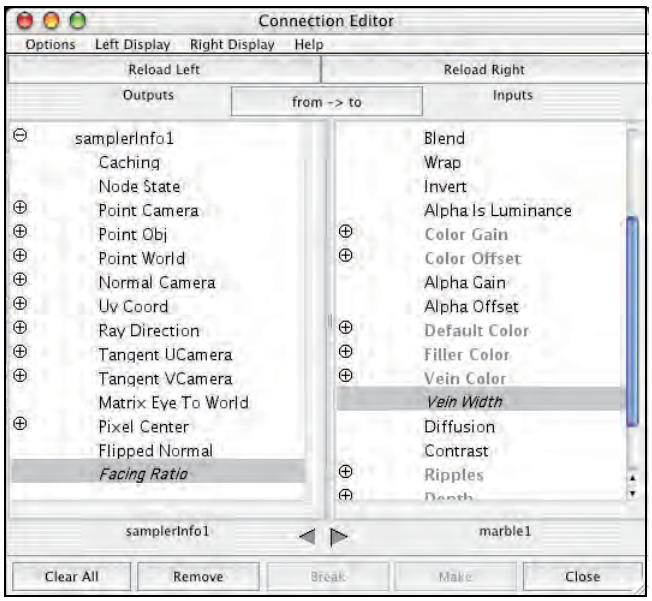
In this first example, the SamplerInfo's Facing Ratio attribute is connected to the Marble texture's Vein Width.

Default.

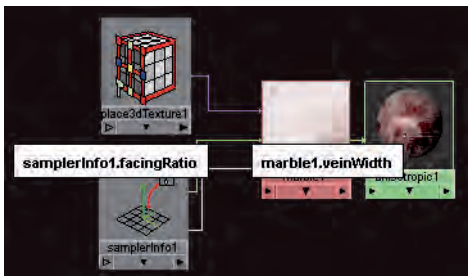




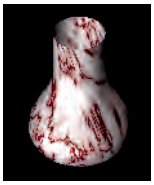
Result when Facing Ratio is connected to the Marble's Vein Width.



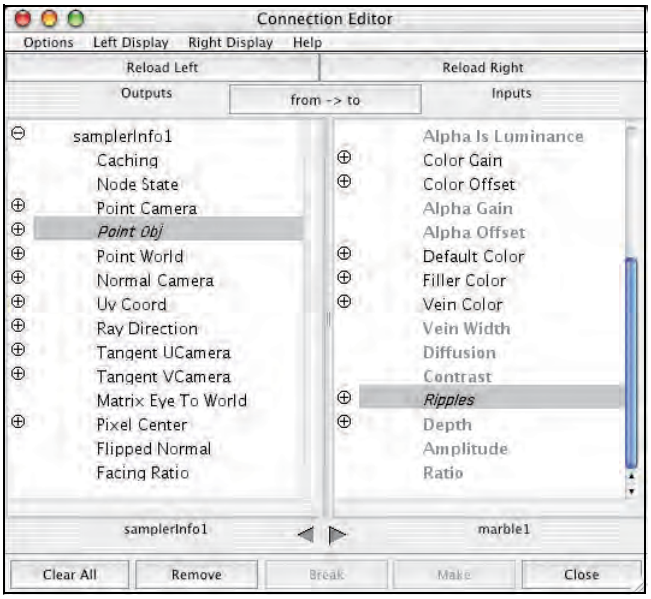
Hypershade view.



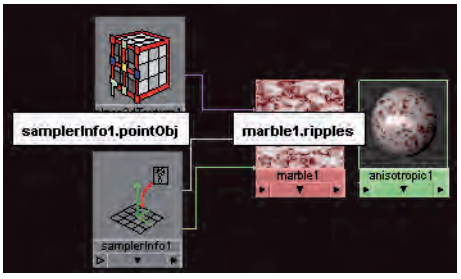
In the following example, the SamplerInfo's Point Obj attribute is connected to the Marble texture's Ripple attribute.



Result when Point Obj is connected to the Ripples attribute.



Hypershade view.

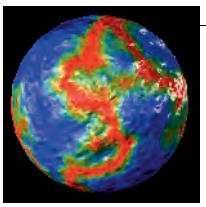


Use the Set Range utility

For a description of the Set Range utility, see ”Set Range” on page 494.

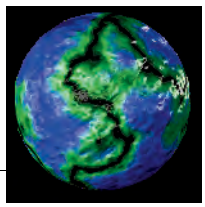
To set the range using the Set Range utility

1 In a texture’s Attribute Editor, map the Set Range utility to an attribute.
The texture attribute changes as soon as you map it to the Set Range utility.

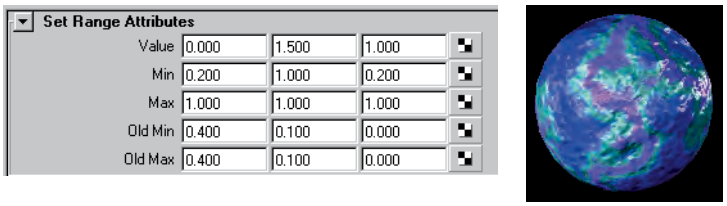


Default Crater colors.

After connecting Set Range to Channel1.



2 Click the box you mapped the attribute to. The Set Range Attribute Editor appears. Adjust the values as necessary.



Set Range Attributes

Value

Maya maps this value from the old range (Old Min to Old Max) into the new range (Min to Max).

Min/Max

The minimum and maximum value in the new range.

Old Min, Old Max

The minimum and maximum value in old range.

Use the Stencil utility

For a description of the Stencil utility, see "Stencil" on page 494.

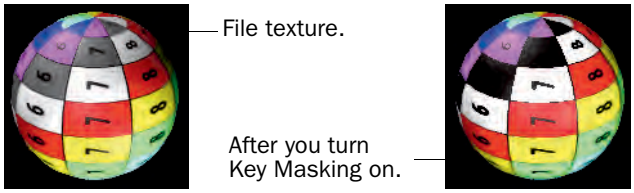
To map a Stencil to an object

1 In a material's Attribute Editor, map the Stencil utility to the Color attribute.
2 In the Stencil's Attribute Editor, map a 2D texture to the Image attribute.
3 Assign the material to the object and adjust the Stencil's attributes as necessary.

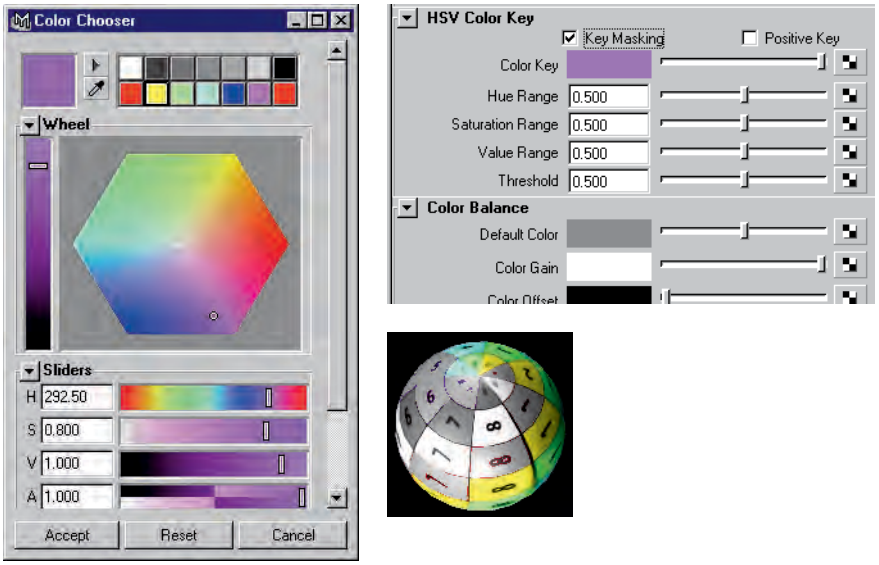
Tip IPR-render to view the result as you adjust attributes.

To use the Key Masking attribute

1 Turn Key Masking on. Since the Color Key attribute's default color is black as well as the Stencil's Default Color, Maya masks out only the areas containing the most black.



2 Change the Color Key color in the Color Chooser. In the following, Maya masks out any color containing red or pink and replaces it with the Stencil's Color Balance Default Color.



Use the Studio Clear Coat utility

For a description of the Studio Clear Coat utility, see "Studio Clear Coat" on page 496.

To create a studioClearCoat node

1 First load studioImport using the Plug-in Manager (Window > Settings/ Preferences > Plug-in Manager).

2 Open the Hypershade (Window > Rendering Editors > Hypershade).

3 From the Hypershade, select Create > General Utilities > Studio Clear Coat. (Close then re-open the Hypershade or the Create Render Node window, if open, to see the plug-in.)

Middle-drag the Studio Clear Coat swatch to create new studioClearCoat nodes.

Use the Vector Product utility

For a description of the Vector Product utility, see "Vector Product" on page 498.

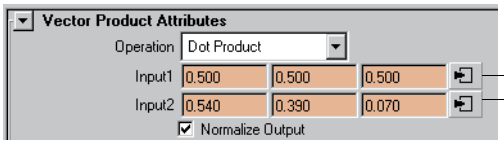
To multiply a vector

1 Create a material.

2 In the material's Attribute Editor, map Vector Product to an attribute, such as Color.

3 In the Vector Product's Attribute Editor, map textures to Input 1 and Input 2.

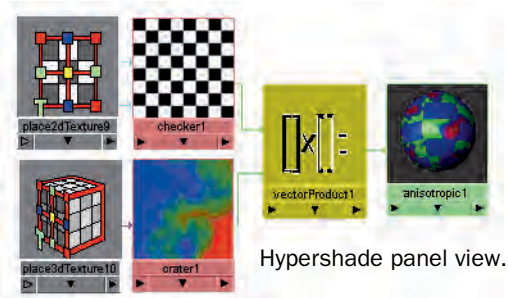
The following examples show the rendered result when you map Input 1 to a Checker texture and Input 2 to a Crater texture.



Click to access texture Attribute Editors.



Dot Product Operation with Normalize Output turned on (default attribute settings).



Hypershade panel view.

4 Click the boxes for Input 1 and Input 2 to access the Attribute Editor for the textures and adjust the attributes as necessary.

Use Color Utilities

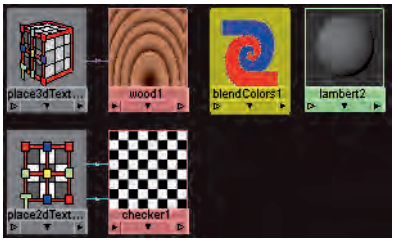
Use the Blend Colors utility

For a description of the Blend Colors utility, see "Blend Colors" on page 499.

To blend colors using the Blend Color utility

Try the following to get an idea of how this utility works.

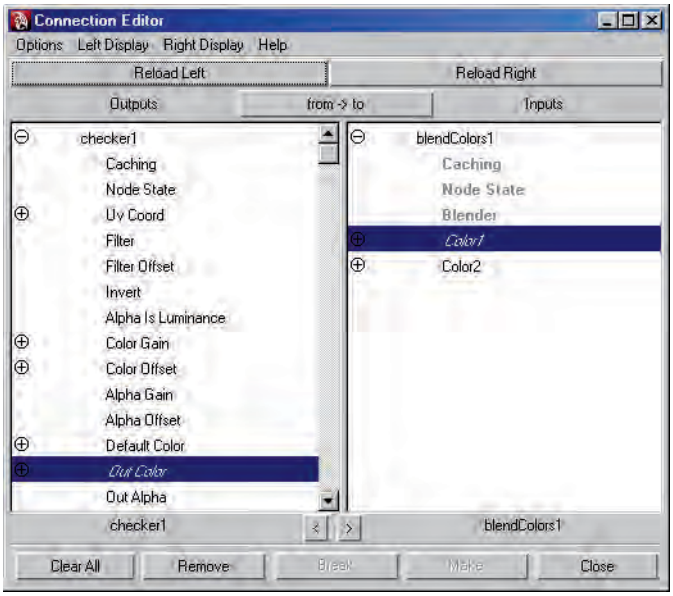
1 Create the following—Checker (2D texture), Wood (3D texture), Blend Color (Color Utilities), and a Lambert material.



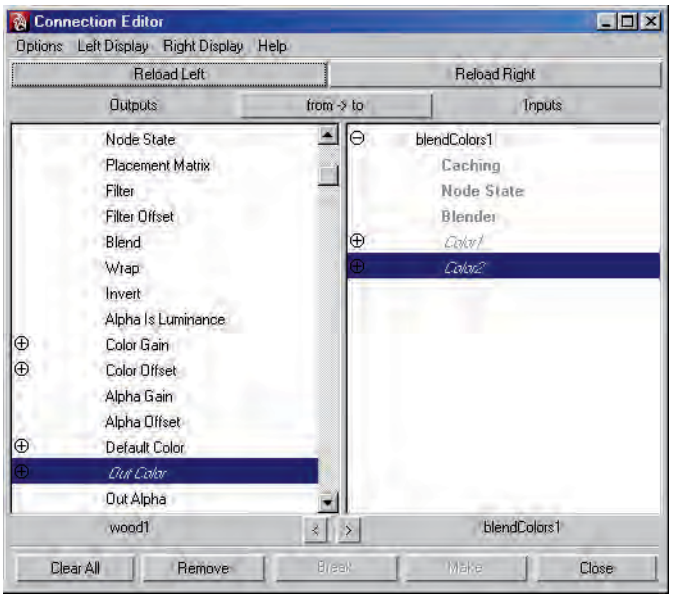
2 Ctrl+middle+drag the Checker swatch over the Blend Color swatch.

The Connection Editor appears.

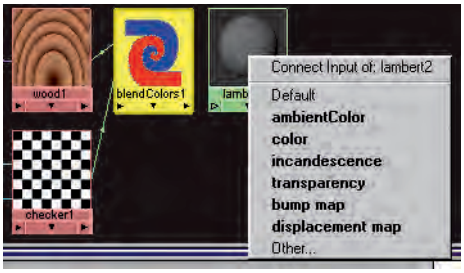
3 Click to connect the Checker's Out Color to the Blend Color's Color1 node.



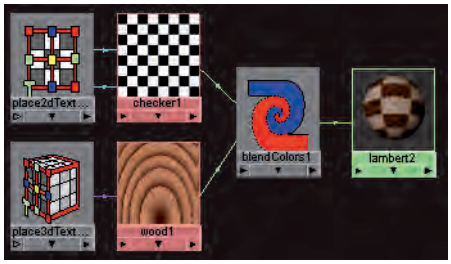
4 Ctrl+middle-drag the Wood texture swatch over the Blend Color swatch, and in the Connection Editor, connect the Wood's Out Color to Blend Color's Color2 node.



5 Middle-drag the Blend Color swatch over the Lambert material swatch and select color from the pop-up menu.



The result is a blend between the wood and checker textures. In the Blend Color's Attribute editor, when you adjust the Blender slider towards 1, more of the checker texture appears and when you adjust the Blender slider towards 0, more of the wood texture appears.



Use the Clamp colors utility

For a description of the Clamp colors utility, see "Clamp" on page 500.

To clamp colors using the Clamp utility

1. Map a complex texture, such as Marble, to a material's Color.
2. In the texture's Attribute Editor, map the Clamp Color Utility to one of the texture's colors.
3. The Clamp utility's Attribute Editor appears.

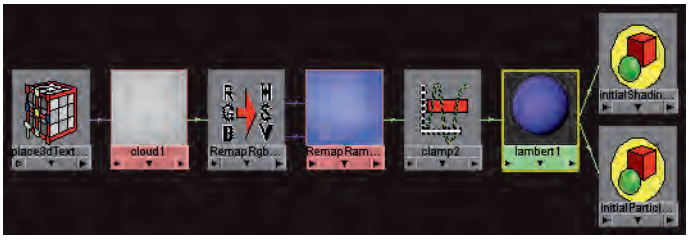
   The Min and Max attribute values determine the amount of Red, Green, or Blue color appears.

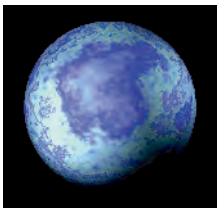
   In the following, in the before image the Min and Max values are set from 0.0 to 1.0 for all three color channels (R, G, and B). The after image Min and Max values are:

   R Min = 0.4, Max = 0.5

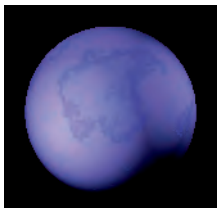
   G Min = 0.4, Max = 0.5

   B Min = 0.4, Max = 1.0





Before Clamp



After Clamp

Use the Contrast utility

For a description of the Contrast utility, see "Contrast" on page 500.

To change the contrast using the Contrast utility

1. Map a texture to a material's color.
2. Map the colors you want to the Contrast utility.

   For example, map the Crease Color of a Leather texture. To do this, click the box next to Crease Color in the Leather texture's Attribute Editor, then select Contrast from the Utilities tab in the Create Render Node window.
3. Change the Contrast attribute settings as necessary.

Use the Gamma Correct utility

For a description of the Gamma Correct utility, see "Gamma Correct" on page 501.

To remap colors using the Gamma Correct utility

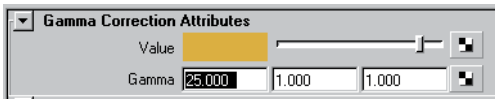
1. Map a texture to a material's Color and assign the material to an object.

   In this example, map a File texture to a Lambert material.



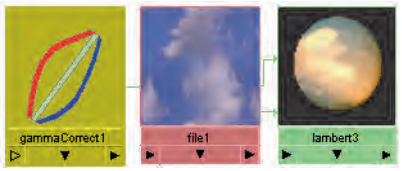
2 Map the Gamma Correct utility to the color you want to adjust, such as the Ambient Color for the Lambert material. To do this, in the Lambert material's Attribute Editor, click the box next to Ambient Color, then select Gamma Correct from the Utilities tab in the Create Render Node window that appears.

3 Change the Gamma Correct attribute settings as necessary, as in the following.



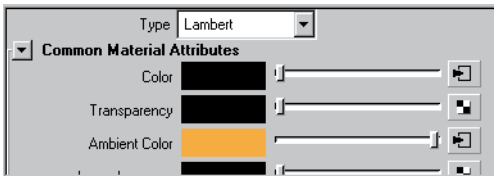


Rendered result.



Hypershade view.

After you change the Gamma Correct attributes, the Ambient Color attribute updates in the Lambert material's Attribute Editor.



Use the Hsv to Rgb utility

For a description of the Hsv to Rgb utility, see "Hsv to Rgb" on page 501.

To use the Hsv to Rgb utility

1 In Hypershade, select Create > Color Utilities > Hsv to Rgb.

The utility node appears in the Hypershade Work Area, and its attributes appear in the Attribute Editor.

2 In the utility's Attribute Editor, adjust the attributes as necessary.

For descriptions of these attributes, see "Hsv to Rgb" on page 501.

Use the Luminance utility

For a description of the Luminance utility, see "Luminance" on page 502.

To use the Luminance utility

1 In Hypershade, select Create > Color Utilities > Luminance.

The utility node appears in the Hypershade Work Area, and its attributes appear in the Attribute Editor.

2 In the utility's Attribute Editor, adjust the attributes as necessary.

For descriptions of these attributes, see "Luminance" on page 502.

Use the Remap Color, Remap Hsv, or Remap Value utilities

For software rendering only.

You can more precisely define how an input value (value, point, color) remaps to a new output value. These three color utility nodes have gradient attributes that give you far greater control over remapping than what Ramp textures provide.

With these utility nodes, you can (for example):

- remap and control color values and alpha values separately
- perform simple color correction
- affect the translation of objects
- fine tune or totally change the hue, saturation, and luminance of a color

Tip These three color utilities work well with the test range feature. See "Test textures (and texture ranges)" on page 96.

To use the Remap Color, Remap Hsv, or Remap Value color utility

1 In Hypershade, select > create Maya Nodes > Color Utilities.

2 Select the utility you want to use:

- See "Remap Value" on page 502 for a description of this utility and strategic uses.
- See "Remap Color" on page 503 for a description of this utility and strategic uses.
- See "Remap HSV" on page 504 for a description of this utility and strategic uses.

3 In the utility's Attribute Editor, adjust the gradient graphs, and set the Input and Output ranges.

For descriptions of these range attributes, see "Input and Output ranges" on page 503.

Use the Rgb to Hsv utility

For a description of the Rgb to Hsv utility, see "Rgb to Hsv" on page 505.

To use the Rgb to Hsv utility

1. In Hypershade, select Create > Color Utilities > Rgb to Hsv.

   The utility node appears in the Hypershade Work Area, and its attributes appear in the Attribute Editor.
2. In the utility's Attribute Editor, adjust the attributes as necessary.

   For descriptions of these attributes, see "Rgb to Hsv" on page 505.

Use the Smear utility

For a description of the Smear utility, see "Smear" on page 504.

To use the Smear utility

1. In Hypershade, select Create > Color Utilities > Smear.

   The utility node appears in the Hypershade Work Area, and its attributes appear in the Attribute Editor.
2. In the utility's Attribute Editor, adjust the attributes as necessary.

   For descriptions of these attributes, see "Smear" on page 504.

Use the Surf. Luminance utility

For a description of the Surf. Luminance utility, see "Surf. Luminance" on page 505.

To use the Surf. Luminance utility

1. In Hypershade, select Create > Color Utilities > Surf. Luminance.

   The utility node appears in the Hypershade Work Area, and its attributes appear in the Attribute Editor.
2. In the utility's Attribute Editor, adjust the attributes as necessary.

   For descriptions of these attributes, see "Surf. Luminance" on page 505.

Use Switch utilities

Use the Single Switch utility

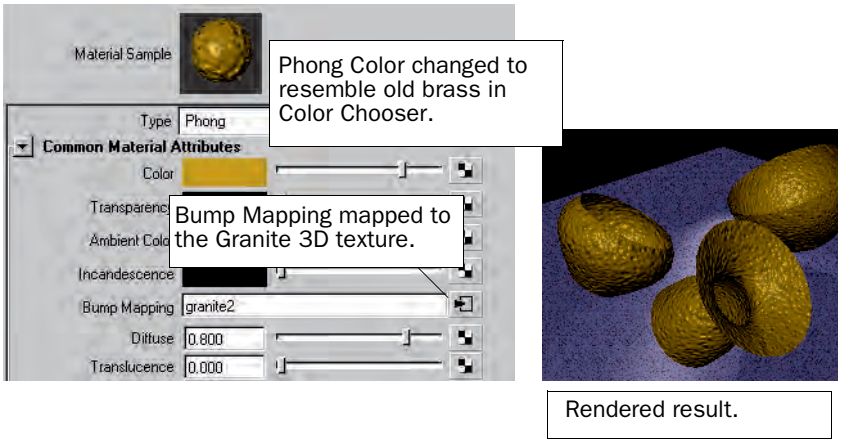
For a description of the Single Switch utility, see "Single Switch" on page 506.

Switches single float attributes, like a Bump Value or Bump Depth.

Tip You can IPR Render the scene to see the results. For more information on IPR rendering, see "Interactive Photorealistic Rendering (IPR)" on page 45 in the *Rendering* guide.

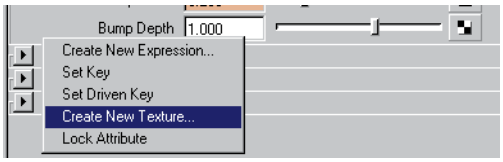
To use the Single Switch utility

1. Create a material and assign it to all the objects in the scene.
2. Map a texture to the material's Bump Mapping attribute. Adjust the texture's attributes and 3D placement if necessary.



Tip If Alpha Luminance is on in the Color Balance section of the texture's Attribute Editor, the rendered result is much smoother. Alpha Luminance is on by default.

3. In the Bump 3d's Attribute Editor, place the cursor over the Bump Depth attribute, then right-click Create New Texture from the pop-up menu.

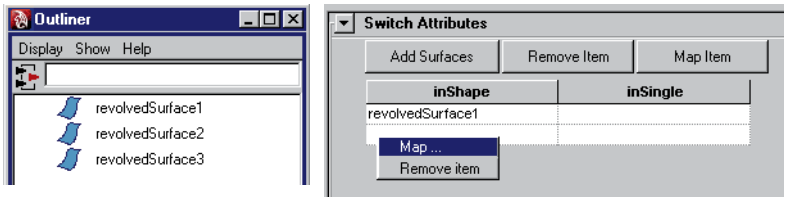


4. Select the Single Shading Switch utility from the Utilities tab in the Create Render Node window.

   The Single Shading Switch's Attribute Editor appears.

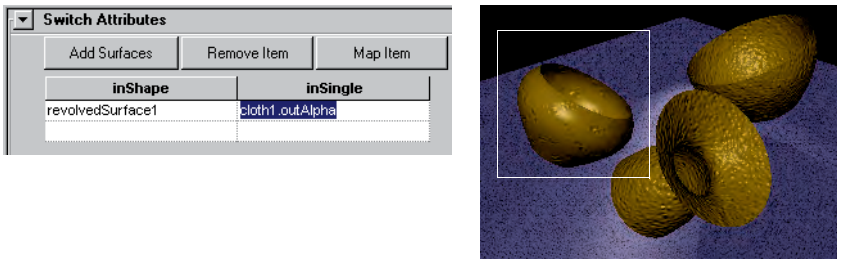
5. Open the Outliner (Window > Outliner) and middle-select one of the objects for which you want object-specific bump mapping. Drag it to the inShape column of the Switch Attributes.

6 Click the name displayed in the inShape column then click the Map Item button (or right-click over the inSingle column and select Map from the pop-up menu).

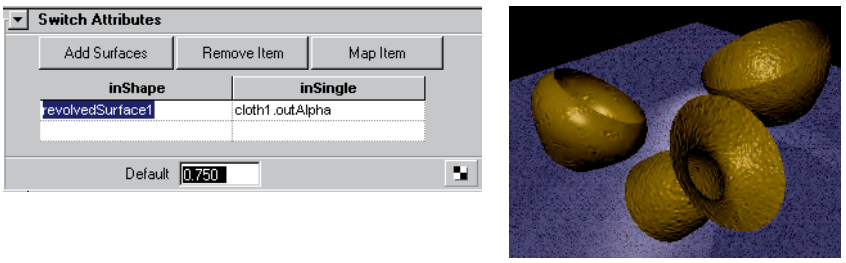


The Create Render Node window appears.

7 Select another texture. The Switch Attributes inSingle column now displays the new texture. Adjust the texture's attributes to get the look you want. Notice in Render View that only one of the object's bump map changes as you adjust the attributes.



8 Now change the Default attribute in the SingleShading Switch's Attribute Editor. The bump maps on the other objects in the scene adjust according to the value you enter.



The following shows how the connections display in Hypershade:



Use the Double Switch utility

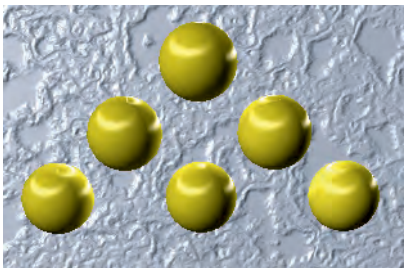
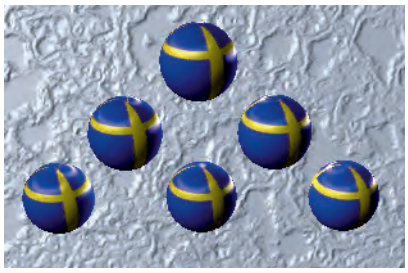
For a description of the Double Switch utility, see ”Double Switch” on page 507.

Switches double float attributes on a 2D texture, like Repeat UV or Translate Frame of a 2D texture placement.

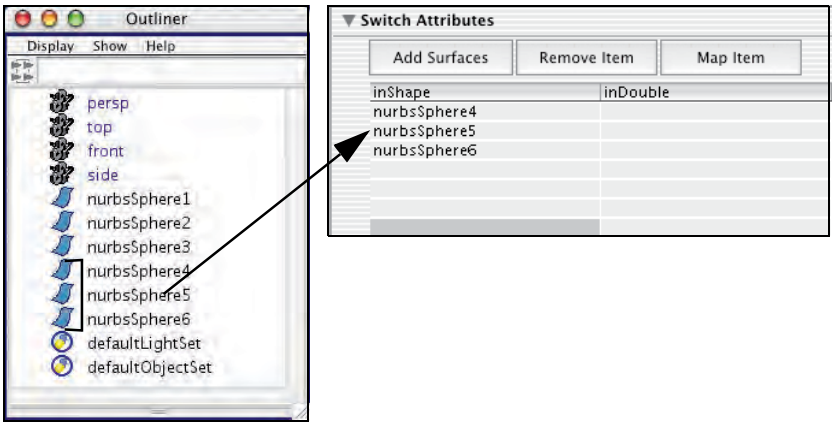
To use the Double Switch utility

1. Create a material and assign it to the objects.
2. Map a 2D texture to one of the material’s attributes, such as Color. Adjust the texture’s attributes if necessary.
3. A place2dTexture node is created when you map a 2D texture. Double-click the texture’s place2dTexture swatch in Hypershade to open its Attribute Editor.
4. Place the cursor over the Repeat UV attribute, and right-click Create New Texture from the pop-up menu.
5. Select the Double Shading Switch utility from the Utilities tab in the Create Render Node window. Notice that the spheres seem to have lost their textures.

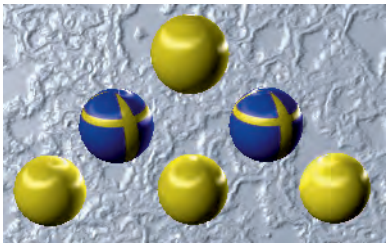
   This is when you can apply a Default setting in the Switch Attributes Editor. You can either map a new texture, or change the values for U and V. In the following the Default value is changed to 1.5 for both U and V.

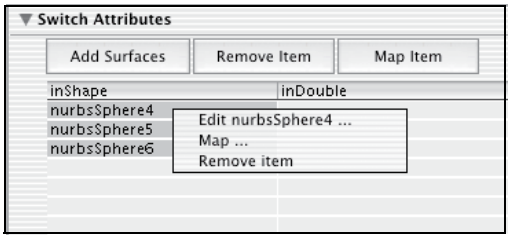
6. Open the Outliner (Window > Outliner) and use the middle mouse button to select the spheres for which you want to adjust the UV texture placement and drag them to the inShape column of the Switch Attributes.



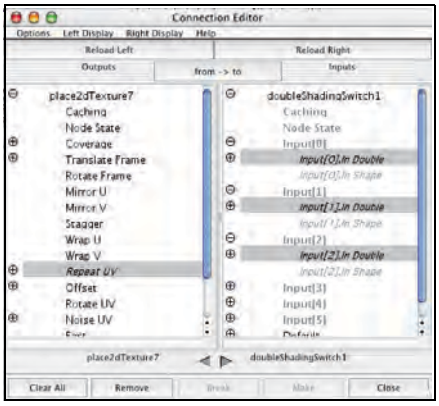
Notice only the spheres you move into the inShape column lose their textures. These are the spheres you want to change.

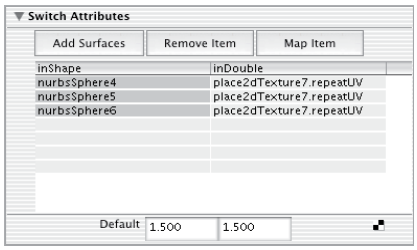


7 Click to highlight the inShape column then click the “Map Item” button.



8 Select the Place 2d Texture utility from the Utilities tab in the Create Render Node window. The Connection Editor appears. Click the *Repeat UV* Output node (in the left column), then the Input[0] In Double Input nodes (in the right column).

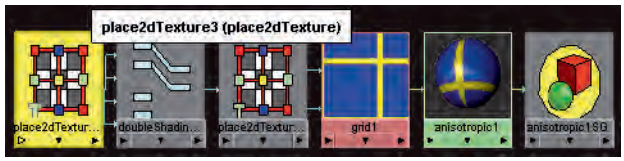


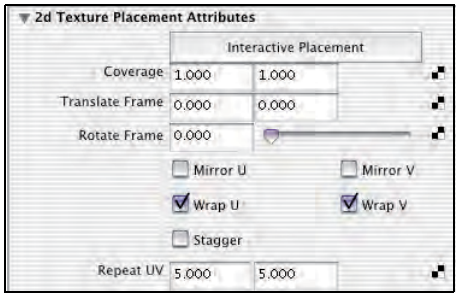


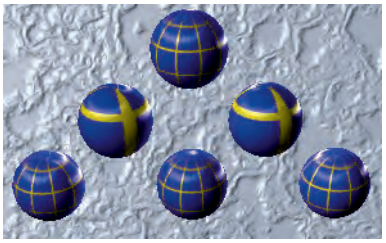
Switch Attributes editor after connections are made.

Only the spheres you mapped in the Double Shading Switch's Attribute Editor update. Click the place2dTexture swatch in Hypershade to open its Attribute Editor and adjust the Repeat UV values if necessary.

Click to open the 2D Texture Placement Attributes Editor and adjust the Repeat UV values as needed.







Use the Triple Switch utility

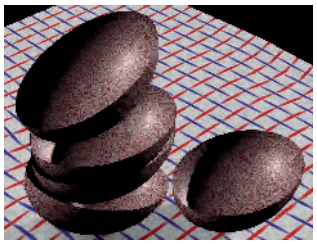
For a description of the Triple Switch utility, see "Triple Switch" on page 508.

Lets you map different textures to several objects in a scene. You can switch any triple float attribute, such as RGB out colors.

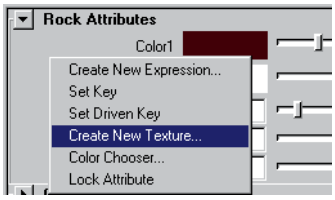
In the following, a Rock texture is initially mapped to the objects (simple revolved surfaces that look like bowls) because a grainy texture is required. The other textures you map onto the selected objects retain this grainy texture while displaying their specific texture attributes.

To use the Triple Switch utility

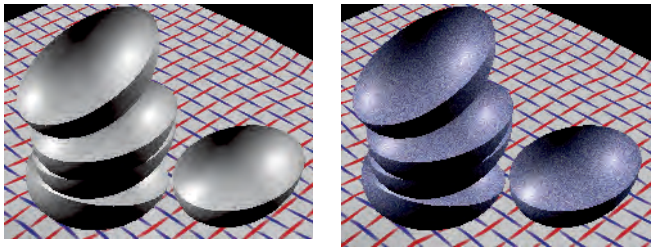
1. Create a material and assign it to all the objects in the scene.
2. In the material's Attribute Editor, map a texture to the Color attribute.



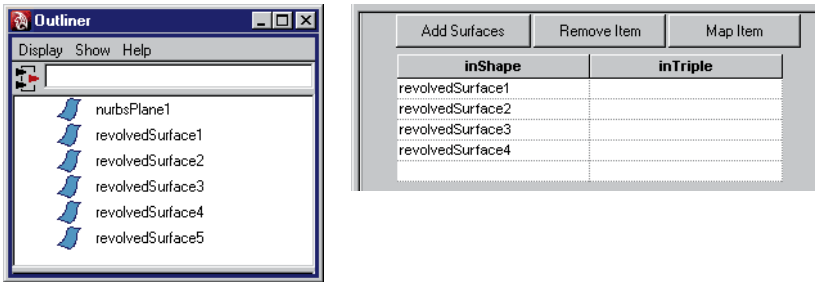
3. In the texture's Attribute Editor, place the cursor over one of the Color attributes then right-click Create New Texture from the pop-up menu.



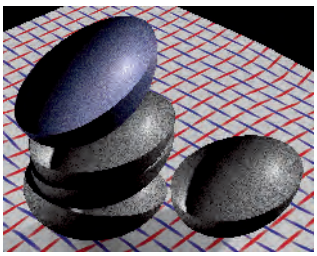
4. From the Create Render Node window, select Triple Switch from the Utilities > Switch tab. Notice that the bowls lose their initial color. You can either map another texture to the objects or change the color using the Default attribute in the Switch Attributes Editor.



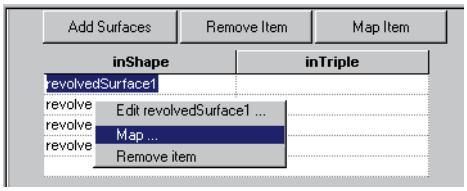
5. Open the Outliner (Window > Outliner), and middle-drag the objects for which you want to display another texture into the inShape column.



Only four of the bowls in the following are to be texture mapped. The top bowl retains the Default color setting.

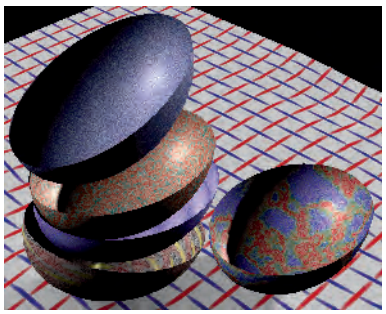


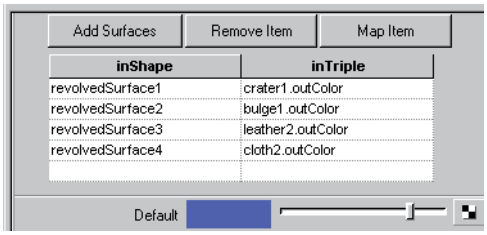
6 To map textures to the other objects, click to highlight the revolved surfaces in the inShape column then select the “Map Item” button.



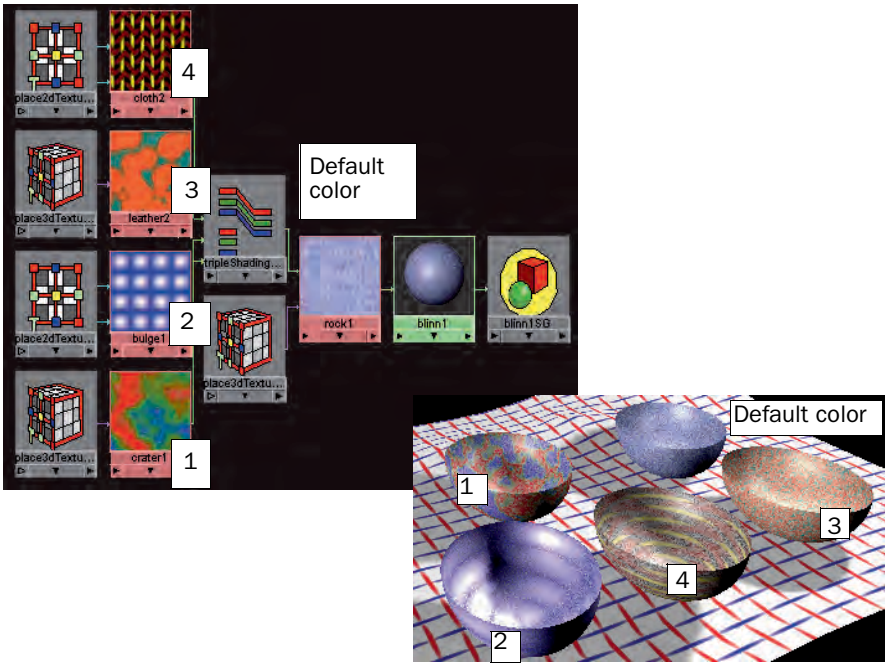
7 Select another texture for each object from the Textures tab in the Create Render Node window.

The following shows the four bowls and the textures mapped to them in the Switch Attributes editor.





Adjust the textures for each item if necessary. The following gives you a better idea of how the textures are mapped to the bowls and how the connections display in the Hypershade.



Use the Quad Switch utility

For a description of the Quad Switch utility, see ”Quad Switch” on page 509.

Lets you map different textures to several objects in a scene. You can switch any quad float attribute, such as RGB out colors.

To use the Quad Switch utility, see ”Triple Switch” on page 508.

9 Appendices

About

Appendix A: mental ray user data nodes

New

The following is a brief explanation of mental ray user data nodes and how they should be used inside Maya.

Overview

mental ray supports a large number of scene entities of a predefined type. In certain applications, however, these entity types are not sufficient to represent data in a scene effectively. In other cases, it is useful for an entity to contain some custom data or custom attributes. To solve these problems, user data entities can be used and placed almost anywhere in a scene.

User data types

Two types of user data are supported:

- *literal* data, a block of bytes, (that is, raw data)
- *declared* data, a block of attributes of known type

Both types of user data have their own specific node representation.

The advantage of declared user data is that mental ray knows the type of the parameters. Therefore, mental ray is able to swap the data properly in case the data has been created on one platform but will be rendered on another with a different byte order (endianess).

The literal user data, on the other hand, should be prepared for swapping if necessary, for example, by adding an integer value which allows it to detect if swapping is necessary, which needs to be performed in the shader which is retrieving the data.

Literal user data

This type of user data is represented with the new Maya node type `mentalrayUserData`. It provides two input attributes `(asciiData` and `binaryData)` to set or to get the ASCII encoding (used in `.mi` files) or the actual block of bytes.

The ASCII representation is simply stored in a node attribute of type string, since it uses only 7-bit characters which can be used inside Maya. The encoding uses two characters for a single byte; thus the length of the string must be a multiple of two. For `.mi` file export, this representation is basically copied. For integrated rendering, the data is decoded in the plug-in and the resulting binary data block is supplied to the mental ray core.

Declared user data

This type of user data is very similar to regular shader nodes, since it provides a set of input attributes. It does not provide output attributes because nothing is computed in difference to shaders, and the node serves only as a data holder.

Like regular custom shaders, this type of node is generated from a *data* `.mi` declaration via the shader manager. The node factory detects that this is a *user data node* and marks such nodes internally with a `miFactoryData` attribute for quick identification.

The Maya user interface is created in the same way as it is for other factory nodes, and allows values to be set in the attribute editor. Connections to other nodes are not supported in mental ray; hence any connection in Maya will be resolved at translation time and exported a fixed value for that frame.

Usage in Maya

Both types of user data nodes can be used in two ways:

- By connecting `mentalrayUserData.message` to `shader.data`.
- By attaching them to various scene entities.

Any user data node should be connected using the standard .message plug. Actually, any other plug can be used for connections as well, the plug itself is not relevant.

You can attach the data nodes inside Maya using the standard tools (for example the Connection Editor, drag and drop from Hypergraph or Hypershade etc.).

Connecting to shaders in Maya should be straight-forward. Connecting to scene entities like shape nodes (including geometry, lights and cameras) or transform nodes (DAG instance) requires you to add a dynamic attribute `miData` (message) and connect it to the user data node so that it is recognized during translation.

Animated data

In an animation, any changes on the attributes or the byte block of the user data between frames are detected by the plug-in, and leads to incremental changes in mental ray, or the exported `.mi` file (if the file per frame option is disabled).

Access in mental ray

When the user data node is attached to a shader parameter, then the data can be accessed in a custom shader using mental ray `mi_db_*()` functions, passing the supplied *tag* value from the input parameter. In most cases, mental ray does not touch the content of the user data (except for potential swapping, see above).

Once the pointer to the user data memory has been retrieved, accessing the values of declared user data is like reading the fields of a C structure with a matching declaration. For literal byte data, the layout of the data is unknown to mental ray, so all structuring and decoding is up to the shaders.

General hints

It is possible in mental ray to “chain” several user data blocks, and attach that chain to a single scene entity. A helpful hint in this case is to add a “magic” number to the user data, preferably as the first value in the block, which lets your shaders identify the user data as the ones you expect.

Appendix B: Phenomenizer

New

The following appendix describes how to create mental ray phenomena inside Maya.

The Phenomenizer is a mental ray for Maya extension that allows you to turn any shading graph consisting of mental ray nodes into a mental ray Phenomenon. This Phenomenon encapsulates the shading graph into a new single shading node with custom input and output parameters, and hides the internal details from the user. Phenomena are stored in regular `.mi` files, and can be loaded into Maya as regular shader nodes using the mental ray Shader Manager. See the mental ray reference guide for more details on Phenomena.

Creating Phenomena

The basis for building and attaching Maya shading graphs is the Maya utility node *MentalRay Phenomenon*, also referred to as *Phenomenizer* node (Maya node type: *mentalrayPhenomenon*). It allows you to attach Maya shading graphs easily, and automatically generates the required input attributes on the Phenomenon node. It also provides access to all the advanced mental ray Phenomenon options. The full phenomenon description can be exported to a `.mi` file for later use.

Phenomenon Options

All Phenomenon options are available in the Attribute Editor of the node grouped under the Options tab. These include version number, apply flags, and requirements. For more information, see Phenomenon in the mental ray reference guide.

Workflow in Maya

To build your phenomenon in Maya

1. Build the initial Phenomenon as follows:
   - Create a Phenomenizer node (In the Hypershade, select Create mental ray nodes > Miscellaneous).
   - Create a mental ray render node intended as the Phenomenon *root*. The output of this node determines the *output* attributes of the whole Phenomenon.

- Shift-drag the node onto the Phenomenizer node. The Connection Editor opens with the two nodes selected.
- Connect the *message* attribute of the node to the Phenomenizer *root* attribute. You may need to select Left/Right Display > Show Hidden to see the message attribute.

Note Upon connecting the *root* node of the Phenomenizer, all additional output (read-only) attributes of that node are also dynamically added to the Phenomenizer node as *output*. They are considered fields of the final output parameter struct of the Phenomenon.

2 Build the shading graph content

- Create and connect new nodes to the root node as driving nodes.
- Set input attributes of those nodes to the desired constant values if they are not going to be exposed as interface parameters.

3 Build the Phenomenon interface

Create input parameters for the Phenomenon from input attributes of any content node by drag-dropping the Phenomenizer onto the desired node, and then connecting an interface array element to the desired attribute.

Notes

- Upon connecting an interface element, the attribute behind that plug is dynamically copied to the Phenomenizer, and can be connected to other nodes. Unlike the root attribute (there can only be one root), more than one connection may originate from a single interface element. The Phenomenizer checks if new connections are compatible with the existing dynamic attribute. If not, the connection is refused and an error message is reported.
- When disconnecting interface elements or the root attribute, the corresponding dynamic attributes are also deleted.

To export the phenomenon to a .mi file

1 Select the Phenomenon node in Maya.

2 Select File > Export Selection > ❐

- Set File type to mentalRay
- Turn on Export selected items only
- Select the filters Factory shaders, and Phenomenizers.

3 Click the Export Selection button.

General Rules

- Mental ray phenomena are considered closed. Shaders inside phenomena must not connect directly to the outer shading graph. Instead, they must pass through the Phenomenon interface.
- mental ray does not support connections to whole parameter struct but only to individual fields. Therefore, interface elements can only be connected to atomic data types (boolean, integer, float, double, and so forth) and compounds with three numeric children (vectors or colors). The mental ray tags are represented as message attributes. Any other type of connection is rejected. Root nodes, however, can have any type of (even compound) result attributes.
- Use of the Connection Editor with the Phenomenizer is encouraged. The Hypershade workflow is somewhat restricted. It does not allow you to connect interface elements to compound plugs and array elements. Furthermore, dynamic attributes may not show up in the UI.
- Save your scene (or shading graph) regularly. The Phenomenon workflow introduces cyclic dependencies into the Maya dependency graph, with the potential to cause problems.

Limitations

- Materials, lights, and instances inside phenomena are not currently supported.
- Attribute naming conflicts are not resolved automatically. When connecting a new interface element to an attribute, the name of that attribute is used as the new name of the corresponding interface attribute. If such a name exists already in the interface, the attribute creation fails. If necessary, rename the attributes in the interface before establishing new interface connections.

10 Shading menus

Reference Window

Window > Rendering Editors > mental ray > Shader Manager

Opens the mental ray Shader Manager window. For more information, see how to use custom mental ray shaders in Maya ”With the mental ray Shader Manager” on page 194.

The following are descriptions of the buttons and options in the mental ray Shader Manager window.

Auto-load

These buttons show which files have been loaded by means of the MI_CUSTOM_SHADER_PATH mechanism.

Information button

This button displays a window that shows you which node types have been created from a loaded declaration file.

Browse button

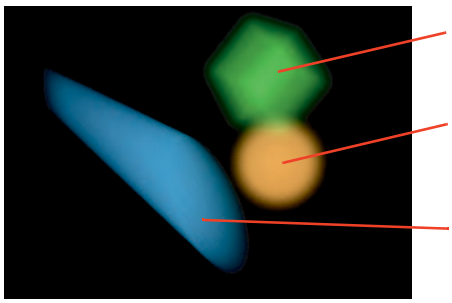
Opens a File Browser window that allows you to locate and load `.mi` declaration files not yet listed in the *Shader Manager*.

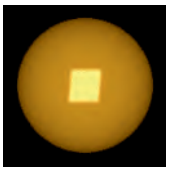
Create

Create > Volume primitives

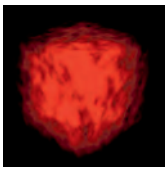
You can use Volume Primitives in conjunction with lights and Volume Fog to produce foggy atmospheric volume effects. For information on Volume Fog, see ”Volume Fog” on page 357.

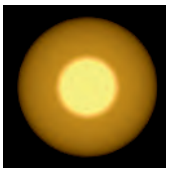
Tip	When rendering shadow maps with volumes (with mental ray), increase the volume samples settings on the volume shape. Also try turning on depth jittering and tuning up mental ray shadow map settings, such as Softness and Samples, on light sources.

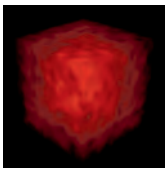



Sphere, Color applied

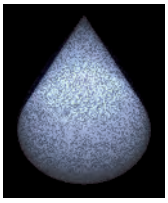
Cube Dropoff Shape

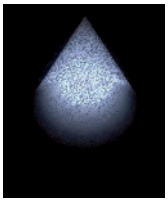

Fractal mapped to Cube's Incandescence

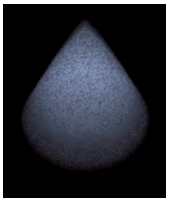

Sphere Dropoff Shape


Scale Opacity decreased

Volume Noise mapped to Cone's Transparency


Dropoff Shape Off


Sphere Shape Off


Cone Shape Off

Rendering menu set

Lighting/shading

Lighting/shading > Material Attributes

Opens the Attribute Editor for the shading group and material assigned to the selected surface.

- For more information on the Attribute Editor, see "Attribute Editor" on page 330 in the *Basics* guide.
- For more information on the shading group, see "Shading group node" on page 23.
- For more information on materials, see "Surface, displacement, volumetric materials" on page 27.

Lighting/shading > Assign New Material

Select an item from the menu to create a new material and assign it to selected object(s).

For more information on materials, see "Surface, displacement, volumetric materials" on page 27.

Automatic Attribute Editor

If on (on by default), the Attribute Editor opens and displays the new material's attributes.

Lighting/shading > Assign Existing Material

Assigns one of the shading groups in the Assign Existing Material sub-menu to all selected surfaces. This menu updates depending on the materials you create.

- For more information on the shading group, see "Shading group node" on page 23.
- For more information on materials, see "Surface, displacement, volumetric materials" on page 27.

Lighting/shading > Assign New Bake Set

Creates a new bake set and assigns selected objects to it.

Items

Texture Bake Set

Creates a new texture bake set and assigns selected objects to it so that you can creates light maps with mental ray for Maya.

For more information, see "Bake sets" on page 148.

Vertex Bake Set

Creates a new vertex bake set and assigns selected objects to it so that you can create light maps with mental ray for Maya.

For more information, see "Bake sets" on page 148.

Lighting/shading > Assign Existing Bake Set

Assigns selected objects to existing bake sets.

For more information on bake sets, see "Bake sets" on page 148.

Lighting/shading > Batch Bake (mental ray)

Bakes selected objects with their respective bake set settings.

For more information on bake sets, see "Bake sets" on page 148.

For more information on a similar function in other renderers see, "Edit > Convert to File Texture" on page 293.

Lighting/shading > Batch Bake (mental ray) > ❐

Objects to Bake

Select from this list to bake all objects, or only selected objects.

Skip objects in initialBakeSets

If you select Select All from the Objects to Bake option, then all objects that are not assigned to the initial bake sets are baked.

For information about initial bake sets, see "Assigning objects to bake sets" on page 148.

Bake To

Bake either textures or vertices. The default is Texture when you access this window through the Lighting/Shading menu. If you select vertices, vertices are baked in the same manner as "Bake vertices" on page 187.

Bake Shadows

Enable this option to bake shadows.

Camera

Select the desired view by specifying the corresponding camera name.

Keep Original Shading Network

Check this option to leave the current shading network intact.

If this option is unchecked, a file texture node will be created and attached to the object's current shading network.

This option is only applicable if you bake to textures.

Regardless of whether this option is checked, a texture file is saved to disk.

Use Bake Set Override

Override the texture Bakeset attributes saved in the scene and use the following settings instead. When this option is checked, the Texture Bake Set Override/Vertices Bake Set Override options become active.

Texture Bake Set Override

Presets

This option allows you to save and reuse the settings you have entered for the attributes below.

Color Mode

Determines the baking mode for the scene. Select one of the following:

Light and Color	Bakes light and color information.
Only Light	Bakes only lighting information.
Only Global Illumination	Bakes only global illumination information
Occlusion	Bakes occlusion information.

Occlusion Rays

Determines the number of occlusion rays to trace per sample point. Increasing the number of occlusion rays improves quality, but reduces performance speed. The default is 64.

Occlusion Falloff

Determines the maximum length of an occlusion ray. Rays longer than this value are not considered for occlusion.

For texture bake sets, if Final Gather is not used, occlusion is computed for all sample points. Although this takes time, the result is very sharp light maps. If Final Gather is used, and the final gather quality is greater than 0, the occlusion is pre-baked into a final gather map. This final gather map can then be interpolated during rendering providing quick results at a reasonable quality.

Normal Direction

Use the Normal Direction drop-down list to set the direction of the baked object's resulting normals. Select from Face Camera (towards the camera), Surface Front (outwards from the object surface), and Surface Back (inwards from the object surface).

Orthogonal Reflection

This option is on by default. When turned on, the Orthogonal Reflection option causes all reflection rays to be orthogonal to the surface being baked. They are no longer true reflection rays, pointing instead parallel to the surface normal vectors, but the resulting baked texture or vertex colors are

meaningful when viewed later from any direction. This option should be turned on if the textures or vertex colors generated are to be used as textures in a game engine.

Turn this option off if you are baking in order to accelerate software rendering and the reflections are only viewed from the baked position. However, in this case, the textures or vertex colors generated are not for use as textures in a game engine.

Prefix

Any bitmaps generated by this bake set are prefixed with what is typed in this box. When Bake to One Map is checked, what you type in this box becomes the filename.

x resolution, y resolution

The horizontal and vertical resolution of the image file, measured in pixels. The slider range is 1 to 512. The default value is 256.

File format

Lets you choose a format in which to save the file texture. The default is IFF.

Bits per channel

Specifies the number of bits per channel to use in the output bitmap.

Number of Samples

Use this option to specify the number of samples (per pixel) that is used for anti-aliasing during baking. The default value is 1, and the maximum value is 4.

Bake to One Map

Any objects assigned to this bake set are baked to the map. (Make sure the object's UVs are not overlapped.)

Bake Alpha

Turn this on to bake the alpha channel (equivalent to Maya's Bake Transparency option) and then select an Alpha Mode.

Note	When you turn Bake Alpha on, the transparency connection is automatically made for you when you add a surface shader.

Alpha mode

When Bake Alpha is turned on, the Alpha Mode specifies how it's computed. Select one of the options, which include Pass Through (alpha as output from shading network) Surface Transparency, Luminance of Surface Color, and Coverage.

Note	The Pass Through option is mainly for custom shader usage within Maya. The returned baked color alpha component is retained and is not further affected by Maya's matte channel. Custom shaders usually set the fourth component of a mental ray color to provide the alpha channel.

Final Gather Quality

Determines the final gather precompute quality. When rendering from the camera, mental ray precomputes a final gather pass before actually rendering the scene. This precomputation pass is disabled by default for baking.

When this attribute is set higher than zero, mental ray computes a number of final gather points before it bakes the lightmap. When this attribute is set to one, the resulting lightmap should be of approximately the same quality as a lightmap rendered from the camera. When this attribute is set higher than one, then the quality of the lightmap is improved as a denser map of final gather points is precomputed.

Do not use this option to tune final gather quality for baking. Final gather quality affects the number of points calculated at the precomputation phase of the final gather algorithm. By increasing the final gather quality, you are only creating more points during precomputation and possibly reducing the amount of interpolation or exterpolation required during rendering. Increasing the final gather quality does not affect the accuracy of the light calculated for each point or the filtering that is used on the data.

Instead, adjust the Scale in the Render Settings window. This attribute controls the accuracy of the light calculated for each final gather point. Adjust also the View (Radii in Pixel Size). This attribute controls how data is interpolated/extrapolated between final gather points.

Final Gather Reflect

Determines the reflectivity of an object when precomputing final gather points for light mapping. This simplifies the simulation of reflective objects whose texture maps include contributions from objects that surround them. For example, if the Final Gather Reflect value is set to 0.25, every fourth final gather point is precomputed on the object hit by the reflection ray.

UV range

Specifies whether to bake the area in UV space from [0,0] to [1,1], bake the entire UV space, or bake a manually specified space range.

U min, U max

Slider values specify how much to stretch the sampling range of U or V components. Maya stretches the sample region to fit the output image size within the [0,0] to [1,1] sampling range.

V min, V max

Minimum V and maximum V for baking.

Fill texture seams

If the selected UV space contains boundaries, these boundaries may appear as black stripes in renderings that use the baked textures. This occurs when the texture is sampled so close to a boundary that the filter picks up values (generally black) from outside the desired space.

This setting artificially extends the boundaries by a small amount to alleviate this problem. It is measured in texels (pixels of texture). Typically, the filter is only a few texels in diameter and can only reach as far as its radius into these boundary spaces, so a value of 1 or 2 is usually enough.

Override mesh UV set assignments

Activate this option to bake meshes as if they were in the specified UV set instead of the UV sets to which they are currently associated.

UV set name

The UV set to use for the meshes in this textureBakeSet.

Vertices Bake Set Override

Presets

This option allows you to save and reuse the settings you have entered for the attributes below.

Color Mode

Determines the baking mode for the scene. Select one of the following:

Light and Color	Bakes light and color information.
Only Light	Bakes only lighting information.
Only Global Illumination	Bakes only global illumination information
Occlusion	Bakes occlusion information.

Occlusion Rays

Determines the number of occlusion rays to trace per sample point. Increasing the number of occlusion rays improves quality, but reduces performance speed. The default is 64.

Occlusion Falloff

Determines the maximum length of an occlusion ray. Rays longer than this value are not considered for occlusion.

Normal Direction

Use the Normal Direction drop-down list to set the direction of the baked object's resulting normals. Select from Face Camera (towards the camera), Surface Front (outwards from the object surface), and Surface Back (inwards from the object surface).

Orthogonal Reflection

This option is on by default. When turned on, the Orthogonal Reflection option causes all reflection rays to be orthogonal to the surface being baked. They are no longer true reflection rays, pointing instead parallel to the surface normal vectors, but the resulting baked texture or vertex colors are meaningful when viewed later from any direction. This option should be turned on if the textures or vertex colors generated are to be used as textures in a game engine.

Turn this option off if you are baking in order to accelerate software rendering and the reflections are only viewed from the baked position. However, in this case, the textures or vertex colors generated are not for use as textures in a game engine.

Color Set Name

Use this option to indicate the color set that you want to bake to.

Bake Color

Turn this attribute off when you do not want to bake the color channel. When this option is on, you can set Min Color and Max Color values, and the Color Blending method. This attribute is on by default.

Bake Alpha

Turn this option on to bake the alpha channel (equivalent to Maya's Bake Transparency option). When this option is turned on, you can set Min Alpha and Max Alpha values, and the Alpha Blending method. This attribute is off by default.

Scale Rgba

Scale vertex colors by the specified value.

Clamp Min, Clamp Max

Turn on these attributes to clamp the minimum and maximum color and alpha values so that the values are forced to be within the set range.

Min Alpha

The lower clamp limit for the alpha channel.

Max Alpha

The upper clamp limit for the alpha channel.

Min Color

The lower limit to which to clamp vertex color.

Max Color

The upper limit to which to clamp vertex colors.

Color Blending

Merges existing vertex colors with the ones just baked, if any. Select a merge method from the Color Blending drop-down list.

Alpha Blending

Merges existing vertex alphas with the ones just baked, if any. Select a merge method from the Alpha Blending drop-down list.

Vertex Color Filtering

Filter Size

If final gathering is baked to vertices and the scene contains high frequency information, discontinuities in the color channel may become visible. This artifact becomes especially apparent if low final gather quality settings are used. Filtering baked vertex colors yields the desired smooth look.

Provide a small positive filter size as argument to this parameter (it is multiplied by the object's bounding box size to obtain the absolute size). Set the Filter Size value to -1 to turn filtering off. Set the value to 0 or larger to turn it on.

Start with values in the 0.1 range as this value is multiplied by the object’s bounding box size to obtain the absolute size. This process also allows smaller values to be used for the Accuracy attribute in the Render Settings Window (mental ray tab > Final Gathering section) for faster performance although accuracy of results may need to be taken into account.

Lower final gather quality settings require larger filter sizes to get a smooth look and renders are less accurate. In general, the final gather quality should be raised as long as rendering times are acceptable; then the filter size should be increased until the desired smooth look is obtained. A tiny filter size may suffice; it enforces that baked colors are shared at vertices which have identical positions and normals.

Filter Normal Tolerance

The filter normal tolerance in degrees (0 to 180).

This lets you adjust the angular tolerance for smoothing value across faces.

Vertices whose angular separation is greater than the entered value are not taken into consideration for filtering so that crisp transitions are maintained across hard edges, and undesired color bleed doesn’t occur.

After adjusting this option, repeat the prelight operation to test. When a fairly smooth result is obtained, use the Filter Size to adjust further.

Use Face Normals

Use this option when you want to specify the use of face normals for baking instead of interpolated vertex normals (the default used for rendering). This option is off by default, and was previously found in the mental ray Baking Options (Batch Bake) dialog box.

Lighting/Shading > Transfer Maps

Updated

Target Meshes

Name

Lists the names of all the objects in your scene currently selected as *targets* in the Transfer Map tool. The target is the object to which you want to bake the texture map. You can right-click the object names in this list to:

- Select the target object in the scene view.
- Remove the object from the list of target meshes.
- Use the target object as a search envelope. See Search Envelope (%) below for more details.

Target UV Set

Sets the UV set on the target mesh for which the texture map is created. The UV set defines how the target mesh is mapped.

Tip	For accurate results, the UV mapping must be non-overlapping (that is, you cannot map two different faces on the target mesh to the same UV region).

Display

Sets what aspects of the target appears in the scene view. You can display: the target mesh, the target meshes' envelope, or both the target mesh and its envelope.

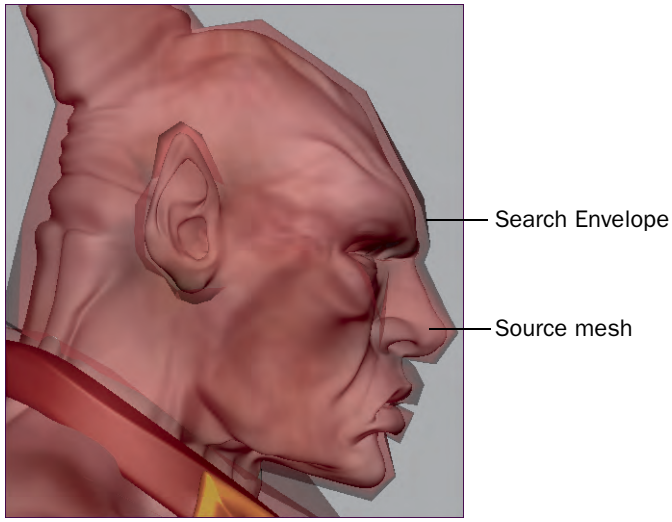
You do not need to change this setting if you are using custom geometry for your search envelope.

Search Envelope (%)

The search envelope is a user-editable piece of geometry that defines the search volume or threshold of the transfer map generation operation.

This attribute sets the size (%) of the target meshes' search envelope. If you set the Search Envelope to 10, then the size of the envelope will be 10% larger than its target mesh.

You can edit the search envelope's vertices to fine tune its shape and coverage.



Add Selected

Adds the currently selected object in the scene view to the Target Mesh list.

Remove Selected

Removes the currently selected object in the scene view from the Target Meshes list.

Clear All

Deletes all the object names listed in the Target Meshes list.

Source Meshes

Name

Lists the names of all the objects in your scene currently selected as *sources* in the Transfer Map tool. The source is the object that has the mesh attributes for which you want to create a texture map. You can right-click the object names in this list to:

- Select the source object in the scene view.
- Remove the object from the list of Source Meshes.

Tip	By default, all meshes in your scene that are not selected as target meshes are loaded as source meshes. For mental ray transfer maps, you can hide an unused mesh to prevent it from being included as a source mesh.

Add Selected

Adds the currently selected object in the scene view to the Source Mesh list.

Add Unselected

Adds all the unselected objects in the scene view to the Source List.

Remove Selected

Removes the currently selected object in the scene view from the Source Meshes list.

Clear All

Deletes all the object names listed in the Source Meshes list.

Output maps

Select a map type from the list of icons available. The section for the selected map type appears. You can create as many maps as you need.



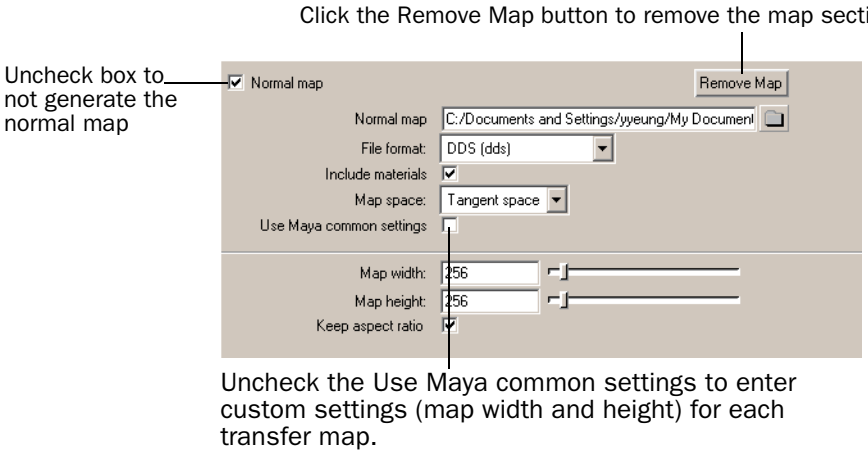
Click on the appropriate icon to create the transfer map of your choice.

Notes

In each section, you can:

- Uncheck the box beside the map type (for example, Normal map) to remove it from the list of maps to generate;
- Click the Remove Map button to remove a map from the list of maps;
- Check the Use Maya common settings or Use mental ray common settings options to honour them;
- Uncheck the Use Maya common settings or Use mental ray common settings options to enter custom settings for each transfer map.

Your settings (for example, the map sections that you have created and checked) are saved with each session of Maya.



Normal Map

Normal Map

Normal maps store all the surface normal information for the source meshes. Normal maps render the target normal vectors and angles so that the texture is mapped to the UV space of the mesh. The texture is sized and positioned depending on the UV parameterization of each mesh.

When on, a *normal map* is generated. Enter the filename and path to which you want to save the map.

Geometry that is normal mapped has a low density of geometry and a lower resolution, which results in quicker rendering of the map. Typically, normal maps react to light better than other types of maps.

Notes

- Normal maps only support *tangent space* maps and they are only visible in the scene view when in High Quality Rendering and Interactive Shading modes.

  If your video card does not support the High Quality Rendering and Interactive Shading modes, set your Shading Network option to *Attach as color channel* to see your normal mapping results in the scene view.
- You can render left handed tangent space normal maps. For more information regarding the left handed tangent space, see "Tangent Space" on page 278 in the *Polygonal Modeling* guide.
- If you want to render your normal map in mental ray for Maya, you must save the normal map in one of the supported formats (EXR, Maya IFF, JPEG, MI, PNG, YUV, RLA, SGI, PIC, TIM, TGA, BMP).

  In addition, you must turn on the *Maya derivatives* option in the Render Settings > mental ray tab > Translation > Performance section. For more information, see "Render Settings: mental ray tab" on page 290 in the *Rendering* guide.

File format

Sets the file format for the normal map you want to create. See "File formats" in the *Rendering* guide.

When you select a file format from the drop-down list, Maya automatically appends the appropriate file extension to the filename of the normal map. For example, if you select gif from the drop-down list, `.gif` is automatically appended to the filename.

Similarly, if you enter `path/mapname.gif` as your filename, the file format option is automatically set to gif.

Tip

The `EXR` file format is recommended. mental ray does not support `DDS` files or `LZW` compressed `.tif` files. If you create a normal map using the Transfer Maps tool and select `tif` as your file format, Maya creates the `.tif` file with a `LZW` compression, which does not work with mental ray. Choose a different file format for your normal map. For more information, see "Troubleshoot mental ray for Maya aborts rendering when using normal maps" on page 202.

Include Materials

When on, all source materials (such as bump maps) are included in the normal map. Use this attribute to obtain a view of normals after they have been modified (e.g. after a bump map has been applied), as they would appear in the final render.Turn this option off to view normals are they are in the actual geometry.

Map Space

Tangent Space Tangent space normals are defined locally, per vertex, and can be rotated by deformation. Use Tangent Space for textures on animated objects.

Object Space Object space normals always point in the same direction, even if the triangle is rotated. Use Object Space for textures on non-animated objects.

Use Maya common settings

If you plan to create several maps with the same width and height, you can reuse your settings by entering them in the Maya Common Output section of the Transfer Maps window.

If you uncheck this option, the Map width and Map height attributes appear within the Normal Map section of the window. For more information regarding these attributes, see “Maya Common Output”.

Tip To add an alpha channel to a color or normal map, see ”To create a texture map with an alpha channel” on page 85.

Displacement Map

Displacement Map

Displacement maps alter the surface of the geometry to simulate 3D surface details. It is created by capturing the height or vertical distance between two points on a surface into a texture map. Displacement occurs along the surface normals according to the intensity of the pixels in the texture map.

When on, a *displacement map* is generated. Enter the path and filename to which you want to save the map.

Geometry that is displacement mapped typically has a higher density of geometry that captures more detail. This is useful for objects viewed in silhouette. Due to their complexity in surface detail, displacement maps take longer to render. For more information, see “Displacement maps” in the *Shading* guide.

Note Displacement map effects are not visible in the scene view and are only visible when software rendered.

File format

Sets the file format for the displacement map you want to create. See “File formats” in the *Rendering* guide.

When you select a file format from the drop-down list, Maya automatically appends the appropriate file extension to the filename of the displacement map. For example, if you select gif from the drop-down list, `.gif` is automatically appended to the filename.

Similarly, if you enter `path/mapname.gif` as your filename, the file format option is automatically set to gif.

Maximum Value

Specifies the maximum value of the color space for the texture map and controls the scale to color range. Use this attribute to control the scale of generated maps. Use 0 to obtain the optimal scale; a maximum range of color will be used.

Use Maya common settings

If you plan to create several maps with the same width and height, you can reuse your settings by entering them in the Maya Common Output section of the Transfer Maps window.

If you uncheck this option, the Map width and Map height attributes appear within the Displacement Map section of the window. For more information regarding these attributes, see “Maya Common Output”.

Diffuse Color Map

Diffuse Color Map

Diffuse color maps contain one or more materials that are sampled into a single color channel. A diffuse color map captures how the target mesh reflects (or scatters) color in many angles. This is useful when you want to create the effect of color spreading freely over a surface.

When on, a *diffuse color map* is generated. Enter the path and filename to which you want to save the map.

File format

Sets the file format for the diffuse color map you want to create. See “File formats” in the *Rendering* guide.

When you select a file format from the drop-down list, Maya automatically appends the appropriate file extension to the filename of the diffuse color map. For example, if you select gif from the drop-down list, `.gif` is automatically appended to the filename.

Similarly, if you enter `path/mapname.gif` as your filename, the file format option is automatically set to gif.

Use Maya common settings

If you plan to create several maps with the same width and height, you can reuse your settings by entering them in the Maya Common Output section of the Transfer Maps window.

If you uncheck this option, the Map width and Map height attributes appear within the Diffuse Color Map section of the window. For more information regarding these attributes, see “Maya Common Output”.

Tip To add an alpha channel to a color or normal map, see ”To create a texture map with an alpha channel” on page 85.

Lit and Shaded Color Map

Lit and Shaded Color Map

Lit and shaded maps contain all the scene lighting information (including diffuse lighting) for the source objects. Samples of the illumination in the source mesh are stored in the lit and shaded color map to be applied to the target mesh.

When on, a *lit and shaded map* is generated. Enter the path and filename to which you want to save the map.

A lit and shaded color map captures how the target mesh reflects (or scatters) light, shadow and color in many angles. This is useful when you want to create the effect of light and color that spreads freely over a mesh.

File format

Sets the file format for the lit and shaded color map you want to create. See “File formats” in the *Rendering* guide.

When you select a file format from the drop-down list, Maya automatically appends the appropriate file extension to the filename of the lit and shaded color map. For example, if you select gif from the drop-down list, `.gif` is automatically appended to the filename.

Similarly, if you enter `path/mapname.gif` as your filename, the file format option is automatically set to gif.

Include Shadows

When on, depth map shadows are included in the texture map you create.

Use Maya common settings

If you plan to create several maps with the same width and height, you can reuse your settings by entering them in the Maya Common Output section of the Transfer Maps window.

If you uncheck this option, the Map width and Map height attributes appear within the Lit and Shaded Color Map section of the window. For more information regarding these attributes, see “Maya Common Output”.

Tip To add an alpha channel to a color or normal map, see ”To create a texture map with an alpha channel” on page 85.

Alpha Map

New

Alpha maps contain transparency information for the source objects. The Transfer Map tool evaluates the transparency on the source object(s) and bakes it to a map for the target object(s).

This map is useful if:

- the source object contains transparent areas; for example, windows or glass.
- there are parts of the target object that do not exist on the source object; for example, the source object contains holes and cavities. A normal map contains the contours of the source object but it does not include the perforations or gaps in the surface. An alpha map captures these cavities and voids.

When on, an alpha map is generated. Enter the path and filename to which you want to save the map.

Tip To add an alpha channel to a color or normal map, see ”To create a texture map with an alpha channel” on page 85.

File format

Sets the file format for the alpha map you want to create. See “File formats” in the *Rendering* guide.

When you select a file format from the drop-down list, Maya automatically appends the appropriate file extension to the filename of the diffuse color map. For example, if you select gif from the drop-down list, `.gif` is automatically appended to the filename.

Similarly, if you enter `path/mapname.gif` as your filename, the file format option is automatically set to gif.

Use Maya common settings

If you plan to create several maps with the same width and height, you can reuse your settings by entering them in the Maya Common Output section of the Transfer Maps window.

If you uncheck this option, the Map width and Map height attributes appear within the Diffuse Color Map section of the window. For more information regarding these attributes, see “Maya Common Output”.

Ambient occlusion Map

Ambient occlusion map

When ambient light is used, the objects in your scene may appear to be too bright and geometric detail may become lost. Ambient occlusion solves this problem by subtracting ambient light and adding shadowing. At each sample point, a number of probe rays are emitted around the normal vector that determine how much light is blocked by other geometry in your scene.

When on, an *ambient occlusion map* is generated. Enter the path and filename to which you want to save the map.

The Transfer Map tool evaluates the ambient occlusion on the high resolution object and bakes it to a map for the low resolution object.

File format

Sets the file format for the ambient occlusion map you want to create. See "File formats" in the *Rendering* guide.

When you select a file format from the drop-down list, Maya automatically appends the appropriate file extension to the filename of the ambient occlusion map. For example, if you select gif from the drop-down list, `.gif` is automatically appended to the filename.

Similarly, if you enter `path/mapname.gif` as your filename, the file format option is automatically set to gif.

Bits per channel

Specifies the number of bits per channel to use in the output bitmap. The options are: 8 bits, 16 bits, and 32 bits.

Occlusion Rays

Determines the number of occlusion rays to trace per sample point. Increasing the number of occlusion rays improves quality, but reduces performance speed. The default is 64.

Tip	The most important parameter for adjusting the quality of your ambient occlusion map is the Occlusion Ray attribute. You can increase the occlusion rays up to 2048.

Occlusion Max Distance

Determines the maximum length of an occlusion ray. Rays longer than this value are not considered for occlusion.

Use mental ray common settings

If you plan to create several maps with the same width and height, you can reuse your settings by entering them in the mental ray Common Output section of the Transfer Maps window.

If you uncheck this option, the Map width and Map height attributes appear within the Ambient occlusion Map section of the window. For more information regarding these attributes, see “mental ray Common Output”.

Custom Map

Custom map

Evaluates your custom shader on the high resolution object and bakes that to a map for the low resolution object. By using this map, you can include geometric detail in your scene without increasing its rendering time. Example custom shaders that you can use include a normal map (map normals to a texture), a bump map (bent normals map), mental ray materials, or shading and lighting maps.

When on, a custom map is generated using the custom shader specified. Enter the path and filename to which you want to save the map.

File format

Sets the file format for the custom map you want to create. See “File formats” in the *Rendering* guide.

When you select a file format from the drop-down list, Maya automatically appends the appropriate file extension to the filename of the custom map. For example, if you select gif from the drop-down list, `.gif` is automatically appended to the filename.

Similarly, if you enter `path/mapname.gif` as your filename, the file format option is automatically set to gif.

Bits per channel

Specifies the number of bits per channel to use in the output bitmap.

Custom shader

Specifies the custom shader for which you want to create a transfer map.

Include Shadows

Bake shadows to your custom maps.

Camera

Specifies the camera name that corresponds to the view you desire.

Use mental ray common settings

If you plan to create several maps with the same width and height, you can reuse your settings by entering them in the mental ray Common Output section of the Transfer Maps window.

If you uncheck this option, the Map width and Map height attributes appear within the Custom Map section of the window. For more information regarding these attributes, see “mental ray Common Output”.

Connect Output Maps

Specifies how the texture you want to create will appear on the target object.

Connect maps to shader

When off, leaves the current network intact and creates the texture file on the disk. Causes no visible changes to your meshes in the scene view. When on, the Connect maps to: New shader and Connect maps to: Assigned shader options become active.

Connect maps to: New shader

Creates a new test shader and connects the following to the new shading network:

- Normal map to the Bump Mapping channel of the new shader
- Displacement map to the new shading group's Displacement Material
- Diffuse color map to the Color channel
- Lit and shaded color map to the Ambient Color channel
- Ambient occlusion map to the Diffuse channel
- Custom map to the Color Channel

Connect maps to: Assigned shader

Attaches the texture map to the target object with the following connections:

- Normal map to the Bump Mapping channel of the target shader
- Displacement map to the shading group's Displacement Material
- Diffuse color map to the Color channel
- Lit and shaded color map to the Ambient Color channel
- Ambient occlusion map to the Diffuse channel
- Custom map to the Color Channel

Notes

- Only one map per type can be connected to a shader. If you create more than one map of the same type (for example, two Normal maps), only the last map in the list is attached to the shader.
- Both the Diffuse color map and Custom map are mapped to the Color channel. If you choose to create both a Diffuse color map and a Custom map, only the last map in the list is attached to the shader.

Maya Common Output

Map width

Sets the width of the texture map to be created, in pixels. The slider snaps to the following texture resolutions: 16, 32, 64, 128, 256, 512, 1024, 2048, 4096. The default map width is 256.

Map height

Sets the height of the texture map to be created, in pixels. The slider snaps to the following texture resolutions: 16, 32, 64, 128, 256, 512, 1024, 2048, 4096. The default map height is 256.

Transfer in

World Space Use World Space when your objects are different sizes. When you transfer in world space, make sure that your source and target objects are at the same positions (on top of each other) in the scene view.

Object Space Use Object Space to see the result of your transfer maps without having to overlap meshes. To ensure that the object space transfer works, move your objects on top of each other (pivots for all meshes overlap), freeze all their transforms, and then move them apart to positions beside each other.

UV Space

New

Use UV Space when your source and target meshes are of different proportions or different shapes. For example, if you are creating both a male and a female character and need to transfer surface attributes from one to another. Even though both meshes have arms, the arms are sufficiently different that spatially based transfers give poor results. Ensure that you define UV space mapping for both meshes.

Note Object Space ignores all transforms (including group transforms) and treats objects individually. If you have multiple source objects (grouped or not) and you want to transfer in object space, freeze the transforms of each of your source objects.

Sampling Quality

Specifies the number of samples per pixel taken from the source mesh for the map and determines the quality of the texture map. Increase the sampling quality for more details in your texture map. However, before tweaking the sampling quality value, you must first ensure that your source object is of high quality. For example, if you are creating an ambient

occlusion transfer map, you should first tweak the number of occlusion rays of your source object to ensure that it provides high quality detail before modifying the Sampling Quality attribute.

Filter Size

Controls the filter size used to interpolate each pixel in the texture map. A small filter size (such as 3) produces a sharper texture map and a large filter size (such as 7) produces a smoother/softer texture map.

Filter Type

Controls how texture maps are blurred or softened to eliminate aliasing or jagged edges. Choose from the following filter types: Gaussian (slightly soft), Triangular (soft), or Box (very soft).

Fill Texture Seams

Calculates additional pixels around each UV shell to remove texture filtering artifacts around UV seams.

Ignore Mirrored Faces

New

When this option is enabled, faces with reverse UV winding order do not contribute to the creation of the transfer map. A typical application of this feature is the creation of mirrored normal maps for a character. See "Creating and using mirrored normal maps on a character or object" on page 87.

mental ray Common Output

Normal Direction

Use the Normal Direction drop-down list to set the direction of the baked object's resulting normals. Select from Face Camera (towards the camera), Surface Front (outwards from the object surface), and Surface Back (inwards from the object surface).

Orthogonal Reflection

This option is on by default. When turned on, the Orthogonal Reflection option causes all reflection rays to be orthogonal to the surface being baked. They are no longer true reflection rays; instead, they point parallel to the surface normal vectors, but the resulting baked texture or vertex colors are meaningful when viewed later from any direction. This option should be turned on if the textures or vertex colors generated are to be used as textures in a game engine.

Turn this option off if you are baking in order to accelerate software rendering and the reflections are only viewed from the baked position. However, in this case, the textures or vertex colors generated are not for use as textures in a game engine.

Map width

Sets the width of the texture map to be created, in pixels. You can select the following texture resolutions: 16, 32, 64, 128, 256, 512, 1024, 2048, 4096. The default map width is 256.

Map height

Sets the height of the texture map to be created, in pixels. You can select the following texture resolutions: 16, 32, 64, 128, 256, 512, 1024, 2048, 4096. The default map height is 256.

Number of Samples

Use this option to specify the number of samples (per pixel) that is used for anti-aliasing during baking. The default value is 1, and the maximum value is 4.

Bake Alpha

Turn this on to bake the alpha channel (equivalent to the Bake Transparency option under Edit > Convert to File Texture (Maya Software) > ❒ in the Hypershade menu bar) and then select an Alpha Mode.

Note	When you turn Bake Alpha on, the transparency connection is automatically made for you when you add a surface shader.

Alpha mode

When Bake Alpha is turned on, the Alpha Mode specifies how it's computed. Select one of the options, which include Pass Through (alpha as output from shading network) Surface Transparency, Luminance of Surface Color, and Coverage.

Note	The Pass Through option is mainly for custom shader usage within Maya. The returned baked color alpha component is retained and is not affected by Maya's matte channel. Custom shaders usually set the fourth component of a mental ray color to provide the alpha channel.

Final Gather Quality

Determines the final gather precompute quality. When rendering from the camera, mental ray precomputes a final gather pass before actually rendering the scene. This precomputation pass is disabled by default for baking.

When this attribute is set to higher than zero, mental ray computes a number of final gather points before it bakes the lightmap. When this attribute is set to one, the resulting lightmap should be of approximately the same quality as

a lightmap rendered from the camera. When this attribute is set higher than one, then the quality of the lightmap is improved as a denser map of final gather points is precomputed.

Do not use this option to tune final gather quality for baking. Final gather quality affects the number of points calculated at the precomputation phase of the final gather algorithm. By increasing the final gather quality, you are only creating more points during precomputation and possibly reducing the amount of interpolation or exterpolation required during rendering. Increasing the final gather quality does not affect the accuracy of the light calculated for each point or the filtering that is used on the data.

Instead, adjust the Scale in the Render Settings window. This attribute controls the accuracy of the light calculated for each final gather point. Adjust also the View (Radii in Pixel Size). This attribute controls how data is interpolated/extrapolated between final gather points.

Final Gather Reflect

Determines the reflectivity of an object when precomputing final gather points for light mapping. This simplifies the simulation of reflective objects whose texture maps include contributions from objects that surround them. For example, if the Final Gather Reflect value is set to 0.25, every fourth final gather point is precomputed on the object hit by the reflection ray.

UV range

Specifies whether to bake the area in UV space from [0,0] to [1,1], bake the entire UV space, or bake a manually specified space range.

U min, U max

Specifies how much to stretch the sampling range of U or V components. Maya stretches the sample region to fit the output image size within the [0,0] to [1,1] sampling range.

V min, V max

Minimum V and maximum V for baking.

Fill texture seams

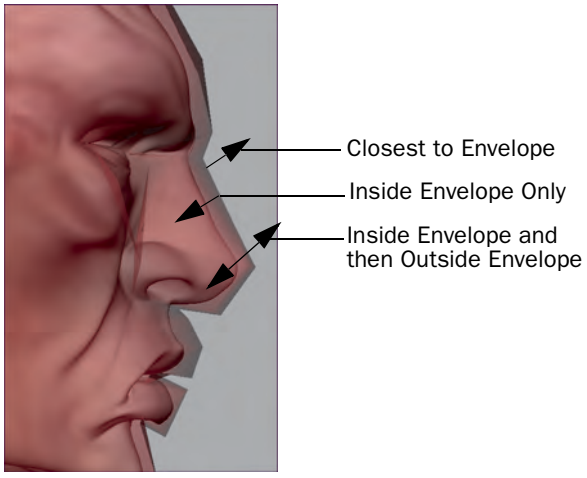
If the selected UV space contains boundaries, these boundaries may appear as black stripes in renderings that use the baked textures. This occurs when the texture is sampled so close to a boundary that the filter picks up values (generally black) from outside the desired space.

This setting artificially extends the boundaries by a small amount to alleviate this problem. It is measured in texels (pixels of texture). Typically, the filter is only a few texels in diameter and can only reach as far as its radius into these boundary spaces, so a value of 1 or 2 is usually enough.

Advanced Options

Search Method

Sets where in relation to the search envelope the target meshes are being looked for.



Closest to Envelope	Search for target meshes outside the envelope.
Inside Envelope and then Outside Envelope	Search inside and outside the envelope for target meshes.
Inside Envelope Only	Search only inside the boundary of the envelope for target meshes.

Max Search Depth (%)

Sets the search depth limit or percentage furthest from the target mesh that a target mesh match will be accepted. This option avoids finding surface intersections on the back sides of objects as search results.

A Max Search Depth of 0.0 sets an unlimited search depth.

Note	Max Search Depth is not supported for Ambient occlusion maps and Custom maps.

Delete Envelopes on Bake

When on, the target objects' search envelopes are deleted on bake.

Match Using

Geometry

Normals	Matches the texture map to the target meshes' face normals on bake. This match method works well on soft edged surfaces.
Surface Normals	Matches the texture map to the target surface's vertex normals on bake. This match method works well on hard edged surfaces.

Texturing

Texturing > Create Texture Reference Object

Creates a texture reference object for the selected surface to lock a 3D texture or projected 2D texture to the surface. As the surface animates or deforms, the texture stays with the surface, producing a very natural looking result.

See also, "Create Texture Reference Object" on page 80.

Texturing > Delete Texture Reference Object

Deletes the texture reference object for the selected surface if one exists. To select a reference object for a selected surface to delete it, either use "Texturing > Select Texture Reference Object" (see next), or click the reference object's heading in the Channel Box.

See also, "Create Texture Reference Object" on page 80.

Texturing > Select Texture Reference Object

Selects the texture reference object for the selected surface if one exists. You can also click its heading in the Channel Box.

See also, "Create Texture Reference Object" on page 80.

Texturing > NURBS Texture Placement Tool

Provides you with a 2D texture placement manipulator for the selected surface. When you create a 2D texture, an icon for the Texture Placement Tool appears in Maya's tool bar.

For more information, see "Texture placement vs. label mapping" on page 39.

Texturing > NURBS Texture Placement Tool > Texture

Placement Options > ❐

Modify texture

Controls which of the texture's 2D Texture Placement attributes you can interactively adjust—Surface mapping or Label Mapping.

Note	See "3D texture positioning" on page 39 to find out how to place 3D textures on surfaces.

Texturing > Create PSD Network

Creates a PSD texture network you can use as a texture map. The Create PSD Network Options window appears.

See "Use PSD Networks as textures in Maya" on page 89 for more information.

Image Name

Type the name of the Adobe Photoshop file you will be painting. By default, Maya uses the scene name and model name.

Size X

Sets the horizontal resolution in pixels.

Size Y

Sets the vertical resolution in pixels.

Keep Aspect Ratio

Constrains the proportions of the X and Y resolution. That is, if you move the X slider, the Y slider moves an equal distance.

Include UV Snapshot

Creates a UV snapshot as a guideline to help you paint with a greater degree of accuracy in Adobe Photoshop.

Position Top and Bottom Radio Buttons

Determines whether the UV layer is created at the top or at the bottom of the layer stack in Adobe Photoshop.

UV Set

Specifies which UV Set to use for the UV Snapshot.

Color Value

Specifies the color to be used for the UV mesh in the snapshot image.

Anti-alias Lines

Specifies whether or not the lines forming the UV mesh in the snapshot image are anti-aliased. Anti-aliased lines appear smoother, but extend over more than one pixel with varying opacity.

Attributes, Selected Attributes

Choose from this list of default Attributes for the material. (If you want more advanced options, turn on Detailed Attribute List.)

Selected attributes in the Selected Attributes list represent the channels to be painted. When you open the PSD file in Adobe Photoshop, each attributes listed here appears as a layer set.

The following table shows the default available channels that correspond to the layer sets that are created when you create the PSD file.

	Lambert	**Blinn**	**Phong**	**Phong E**
Color	x	x	x	x
Transparency	x	x	x	x
Ambient Color	x	x	x	x
Incandescence	x	x	x	x
Bump Map (Normal Camera)	x	x	x	x
Displacement	x	x	x	x
Diffuse	x	x	x	x
Translucence	x	x	x	x
Specular Color		x	x	x
Reflectivity		x	x	x
Reflected Color		x	x	x
Eccentricity		x		
Specular Rolloff		x		
Roughness				x
Highlight size				x

	Lambert	Blinn	Phong	Phong E
Whiteness				x
Cosine Power			x	

Detailed Attribute List

Shows a more detailed list of advanced options you can paint.

Texturing > Update PSD Networks

When you modify a PSD file (in Adobe Photoshop) that is connected to a Maya PSD node (in Maya), you can update (refresh) the image in Maya to show the modifications immediately.

See "Update PSD Networks" on page 95.

Reference > Texturing > Update PSD Networks

11 Shading Windows and Editors

Reference

mental ray Custom text editor

For more information on the mental ray Custom Text Editor, see ”Custom mental ray text” on page 170.

custom shader text

Enabled when selecting any light, any camera, any shading group, except the initial variants, any shader, except Maya’s default lambert1 and particleCloud1.

custom object text

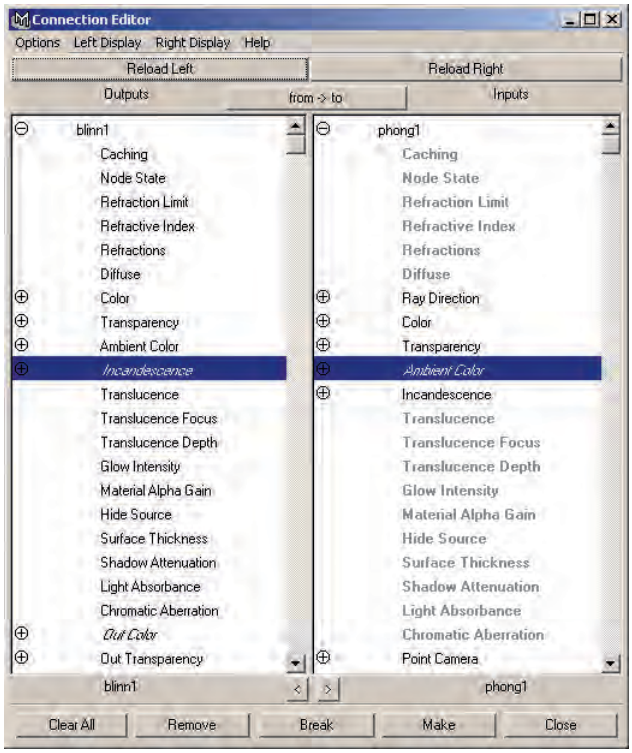
Enabled when a mesh or NURBS shape is selected. If a direct transform of a shape is selected, the underlying shape is automatically determined and used.

Connection Editor

Updated

The Connection Editor provides node network information in a side-by-side layout where you can view two connected nodes in a node network. This editor is useful for fine-tuning a shading network.

You can quickly and easily traverse from node to node and show a node’s outputs or inputs to facilitate connections, meaning you can make connections in either direction in a node network.



Note	Some utility nodes can only be connected to a material's attributes through the Connection Editor.

Connected attributes in the Connection Editor appear in italics (Mac OS X excepted), while non-keyable attributes appear dimmed. Some dimmed attributes indicate a nested list of attributes. Double-click the attribute, or expand the attribute to view the connectable nodes.

To connect nodes with the Connection Editor, see "Connect render nodes using the Connection Editor" on page 63.

Connection Editor buttons

The Connection Editor's buttons control how connections are made.

Reload Left and Reload Right

Loads a node into the output or input panes of the Connection Editor. Select a node, object, or shader and click Reload Left or Reload Right.

from -> to

Switches the output attributes to input attributes, and the input attributes to output attributes.

Arrow buttons (< >)

Moves the output node into the input pane (<), or moves the input node into the output pane (>).

Clear All

Removes the nodes from the output and input panes.

Remove

Removes the node in the output pane.

Break

Breaks the selected connection. Select the connection you want to break from the output pane, then click Break. This button is only available when the Auto-connect option is off.

Make

Makes a connection between the selected attributes. Select an output attribute, and select an input attribute, then click Make. This button is only available when the Auto-connect option is off.

Close

Closes the Connection Editor.

Connection Editor menu bar

Options > Auto-connect

Causes a connection to be created automatically, when you select an output attribute and an input attribute. This option is on by default.

Options > Channel Names

New

Changes the way the attributes are displayed in the Connection Editor. The Nice setting displays the names in the most readable manner with leading capitalizations and spaces. The Long setting displays the attributes in the same manner as nodes are displayed. The Short setting displays names as short forms, for example, Bounding box displays as bb.

Options > Attribute Order

New

Changes the order in which the attributes are displayed in the Connection Editor's list. Attributes can be sorted in ascending or descending alphabetical order.

Left Display > Show Readable and Right Display > Show Readable

Displays all the attributes for the node, regardless of whether the attribute is keyable or not. This option is on by default.

Left Display > Show Outputs Only and Right Display > Show Outputs Only

Displays only the output connections for the selected node.

Left Display > Show Inputs Only and Right Display > Show Inputs Only

Displays only the input connections for the selected node.

Left Display > Show Non-Keyable and Right Display > Show Non-Keyable

Displays the non-keyable (attributes you cannot create connections for) attributes of the node. This option is on when the Show Readable option is on.

Left Display > Show Connected Only and Right Display > Show Connected Only

Displays only the attributes that have connections.

Left Display > Show Hidden and Right Display > Show Hidden

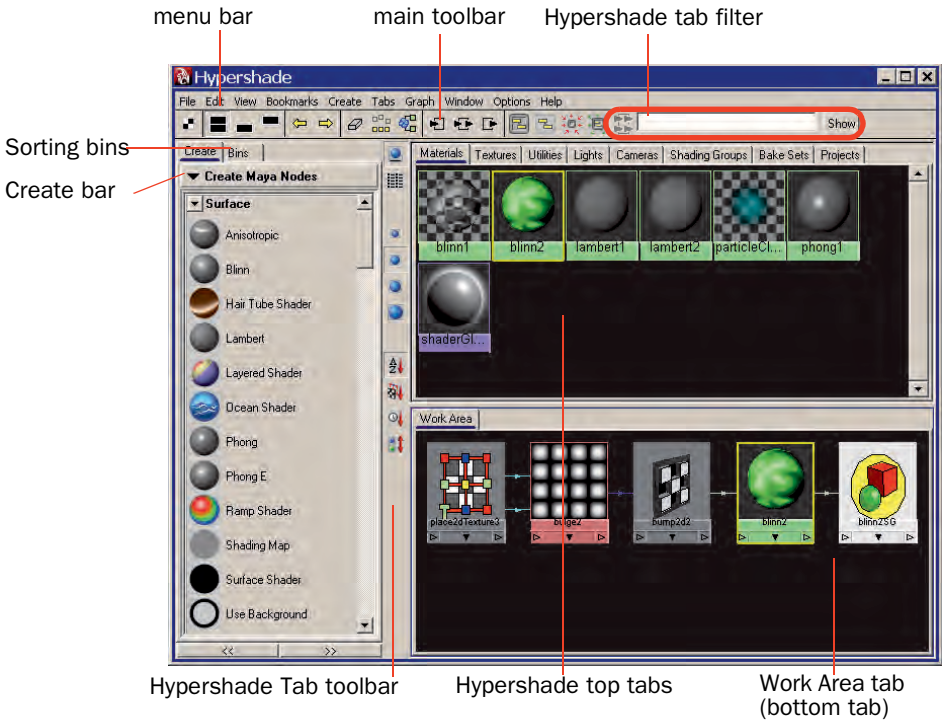
Displays hidden attributes for the node.

Hypershade

Hypershade window

The Hypershade is the central working area of Maya rendering, where you can build shading networks by creating, editing, and connecting rendering nodes, such as textures, materials, lights, rendering utilities, and special effects.

To open and customize Hypershade, see "Open and navigate Hypershade" on page 44.



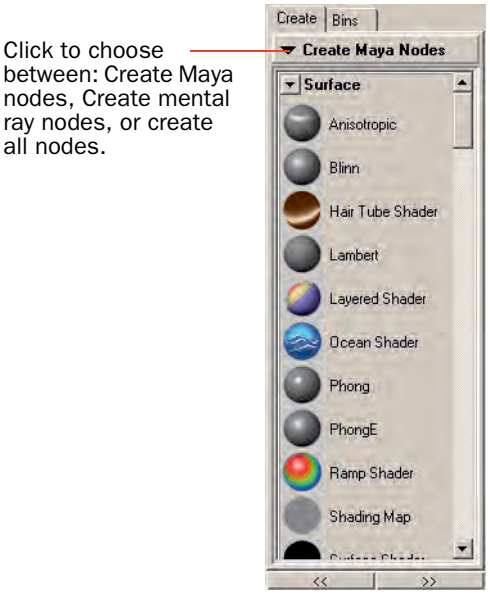
The Hypershade consists of the following components:

- Create bar
- Sorting Bins
- Tabs
  - Hypershade top tabs
  - Work Area tab (bottom tab)
- Toolbars
  - Hypershade main toolbar
  - Hypershade tab toolbar
- Hypershade tab filter
- Hypershade menus

Notes To display the Hypershade/Persp in a vertical side-by-side orientation, click the Hypershade/Persp quick layout button 

Create bar

When you first open Hypershade, the Create Bar panel appears at the left. From this panel, you can choose among node types that let you create different types of rendering effects.



Click the bar to display Maya nodes, mental ray nodes, or all nodes. Different types of nodes are nested in sections within the bar. Use the scroll bar to navigate through the Create bar and select the node that you want to create.

The Create bar is very similar to the Create Render Node window. For a description of what is in the Create bar, see ”Create Render Node window” on page 302.

You can hide or resize the Create bar, or, you can customize the display of its icons. For more information, see ”Hide, resize or customize the Create bar” on page 49.

Creating render nodes

See ”Create a node” on page 53 for more information on how to create a render node.

For more information regarding the Maya render nodes that you can create via the Create bar, see:

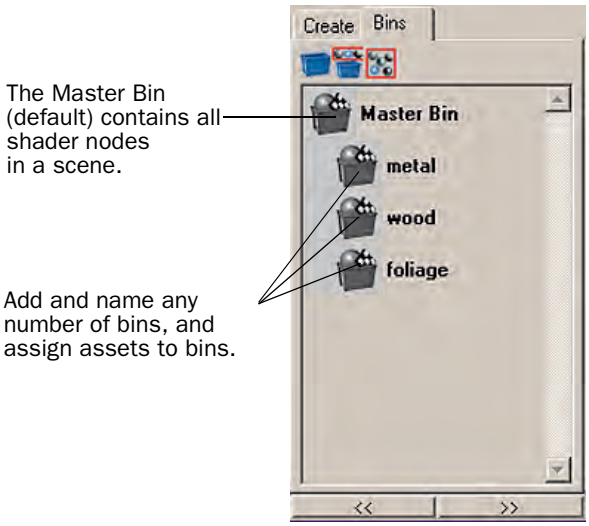
- ”About surface materials” on page 311
- ”About displacement material” on page 350
- ”About volumetric materials” on page 351
- ”About 2D textures” on page 367

- ”About 3D textures” on page 389
- ”About environment textures” on page 408
- ”Layered texture” on page 418
- ”Sources of direct light” on page 16
- ”About General Utilities” on page 472
- ”About Color Utilities” on page 499
- ”About Switch Utilities” on page 505
- ”Image plane” on page 454
- ”Optical FX Attributes” on page 156

For information regarding mental ray for Maya render nodes, see:

- ”mental ray for Maya nodes” on page 423

Sorting Bins



Use Sorting bins, which are containers for shading nodes (materials, textures, and so on), to help you organize and track shading nodes in your scenes.

A default Master bin contains all shading nodes in your scene. You can add any number of additional bins to a scene and assign nodes to one or more of those bins. By strategically naming the bins, (for example, wood, metal, doors, foliage), you can quickly and more easily locate shading assets to work with them.

Notes	
	• When a node is assigned to a bin, all the shading nodes upstream to this node are also assigned to this bin. • The Hypershade asset tabs (Materials, Textures, and so on) exist for all sorting bins, allowing for further organization and filtering. • While shading nodes can be assigned to more than one bin, they are not duplicated in the scene. • You can rename an existing bin by double-clicking it.

Organizing your sorting bin

For more information on how to organize nodes within your sorting bins, see ”Organize render nodes with Hypershade sorting bins” on page 51.

Hypershade tabs

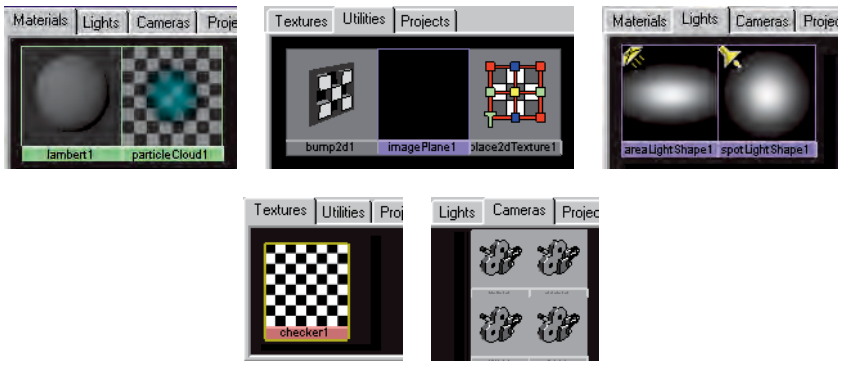
Hypershade top tabs

In the top panel of the Hypershade are tabs containing the rendering components that contribute to the current scene.



Tip	You can customize the Hypershade to display only the top tabs or only the bottom tabs. For more information, see "Show top and bottom level tabs" on page 46.

Each Hypershade tab displays specific rendering node as a node icon (a swatch), that visually represents the characteristics of the node. When you edit a node's attributes or assign textures or special effects, the swatch updates in Hypershade.

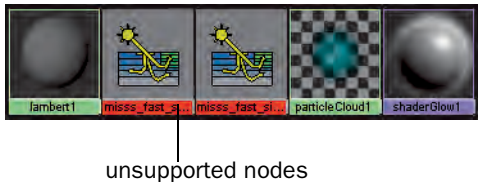


Create additional Hypershade tabs

You can customize the top panel of your Hypershade by creating additional tabs. For more information, see "Create Hypershade tabs" on page 47.

Unsupported nodes

The Hypershade indicates when a node is unsupported by the currently specified renderer in the Render Settings window. Unsupported nodes appear with a red swatch label. For example, when the renderer is set to Maya Software in a scene containing a mental ray for Maya node, such as misss_fast_shader, the unsupported misss_fast_shader appears with a red swatch label.



Projects tab

The Projects tab displays the contents of the default projects directory.

If you keep projects elsewhere, create a new disk tab pointing to the directory in which you keep your projects. See "To create a new tab in Hypershade" on page 47.

For example:

- Windows

  `drive:\Documents and Settings\username\My Documents\maya\projects`

- Mac OS X

  `/Users/username/Documents/maya/projects.`

- Linux

  `~username/maya/projects`

Work Area tab (bottom tab)

Displays the shading network for a selected node. For more information about Shading networks, see "About shading networks" on page 23.

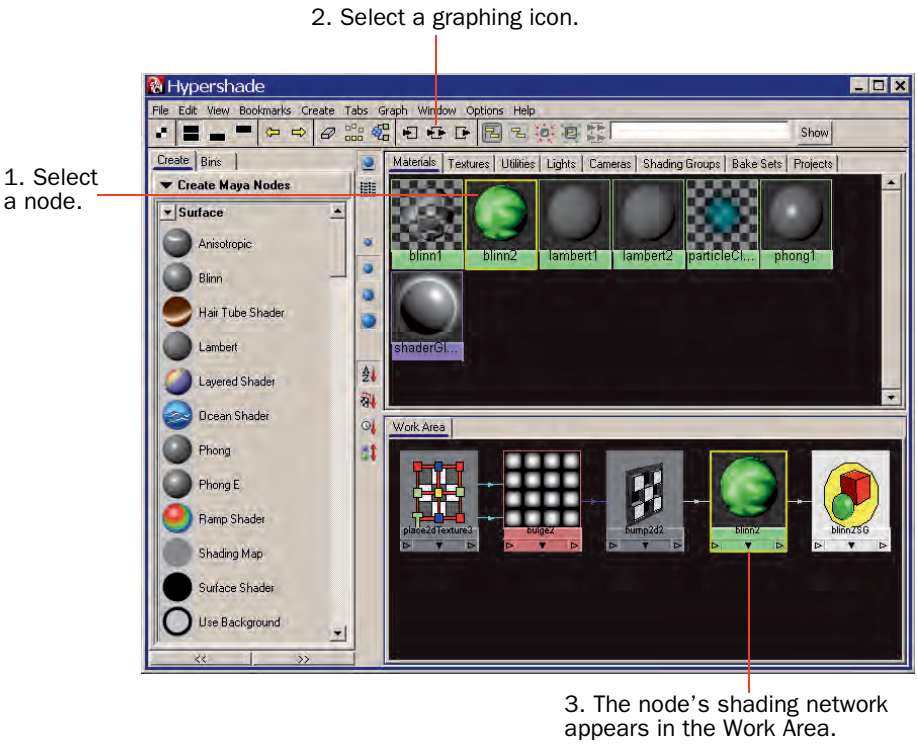
Select a node, then select one of the graphing icons on the tool bar, such as Input Connections  . The selected nodes appear in the Work Area tab. If another Work Area tab is selected, the graph operation graphs the selected nodes into that tab. (The Work Area tab cannot be deleted.)

For more information on how to show node connections, see "Show node connections" on page 56.

Connecting render nodes in your Work Area

You can use the Hypershade to show render node connections, connect render nodes, or delete render node connections. For more information, see:

- "Connect render nodes using their default connections" on page 61
- "Connect render nodes by dragging existing connection lines" on page 62
- "Delete a render node connection" on page 65



Tip	You can customize the Hypershade to display only the top tab or only the bottom tab. For more information, see "Show top and bottom level tabs" on page 46.

Customizing your Work Area

You can customize your Work Area to display only specific shapes and transforms. For more information, see "Hide shape and transform nodes in Hypershade" on page 47.

You can also customize your Hypershade by changing the default connection line colors. For more information, see "Change default connection line colors" on page 53.

Hypershade toolbars

Hypershade main toolbar

Updated

These are the buttons on the Hypershade main toolbar. For more information about Hypershade, see "Hypershade window" on page 278.

Create Bar On/Off

 Displays or hides the Create Bar. See "Create bar" on page 280.

Show top and bottom tabs

 Show top and bottom tabs

 Show top tabs

 Show bottom tabs

Select these buttons to show the top tabs (containing rendering components) or the bottom tab (Work area tab) or to display both sets of tabs.

You can also access these functions from the Tabs menu in the Hypershade menu bar.

Show Previous Graph, Show Next Graph

 Show Previous Graph

 Show Next Graph

These work just like Back and Forward page commands in a web browser. As you graph and work with networks in the Work Area, Hypershade remembers the networks that have been shown. Use Show Previous Graph to step back through the networks. Use Show Next Graph to move forward through the networks.

The hot keys for the Show Previous Graph and Show Next Graph operations are "[" and "]" respectively.

You can also access these functions from the Graph menu of the Hypershade menu bar.

Clear Graph

 Clears the current Hypershade layout.

You can also access this function from the Hypershade menu bar (Graph > Clear Graph).

Rearrange Graph

 Rearranges the nodes in the current layout to display all nodes and networks.

You can also access this function from the Hypershade menu bar (Graph > Rearrange Graph).

Graph Materials on Selected Objects

 Displays the Hypershade layout of nodes and, or shading networks for the selected objects.

You can also access this function from the Hypershade menu bar (Graph > Graph Materials on Selected Objects).

Input Connections

 Displays only the input connections of selected nodes. See also ”Input Connections” on page 57.

For more information on render node connections, see ”Render node connections” on page 25.

You can also access this function from the Hypershade menu bar (Graph > Input Connections).

Input and Output Connections

 Displays the input and output connections of the selected nodes. See also ”Input and Output Connections” on page 57.

For more information on render node connections, see ”Render node connections” on page 25.

You can also access this function from the Hypershade menu bar (Graph > Input and Output Connections).

Output Connections

 Displays only the output connections of selected nodes. See also “Output Connections”.

For more information on render node connections, see ”Render node connections” on page 25.

You can also access this function from the Hypershade menu bar (Graph > Output Connections).

Create Container



 Adds a new container node to the Work Area and adds any selected nodes to it. Node connections between the original nodes are maintained. In addition, unique attributes can be added to the container node.

Remove Container

New

 Removes the selected container node from the Hypershade. Connections to and from nodes inside of the container node are unaffected.

When the container node is nested within one or more other container nodes, the nodes within the container being removed are moved into the parent container node one level up in the hierarchy.

Collapse Container

New

 Reduces the selected container node to the size of one node. All nodes within the container are not displayed but instead represented by the container node. The container node is differentiated from other nodes in the Input/Output connections graph by its thick, round-cornered border.

Expand Container

New

 Increases the display size of the selected container node(s) to display all of the nodes within.

See ”Assemble nodes into logical groupings using container nodes in the Hypershade” on page 57 for more information on how to use container nodes.

Tips	You can double-click the container node to toggle between the collapsed view and the expanded view.

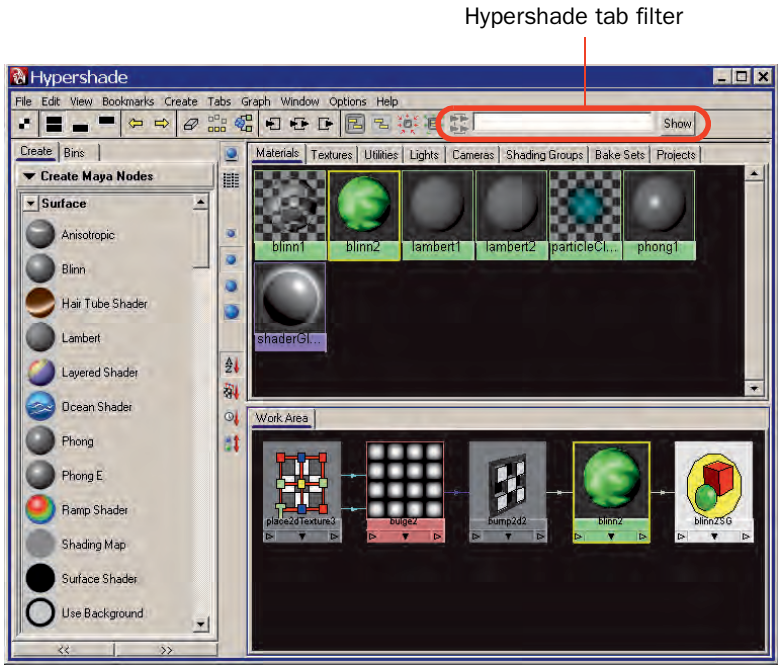
Hypershade tab filter

Every scene tab (also called an Asset tab) in Hypershade has controls for filtering the nodes displayed in the tab (similar to the ones in HyperGraph).

By default, each scene tab has an implicit filter that is determined by the tab type specified when the tab was created (or by the default tabs when the scene was first created). The tab only displays nodes that pass this filter, and you cannot disable this filter. For example, a Materials tab shows only material nodes.

However, you can filter the nodes in a tab by name (in the text box) or by type (with the Show button).

At any given time, one or more of these filters can apply to each scene tab. Only nodes that pass all of the applied filters are displayed. You can clear filters at any time.



Clear button

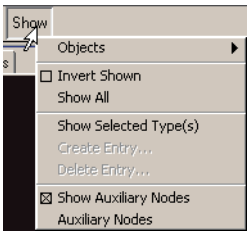
 Click to clear any applied filters (beyond the implicit one) and return the tab to its default contents.

The text box

Lets you type in a character string, which can be a regular expression, to specify by name the nodes to be shown. Only nodes whose name matches the character string are displayed in the tab.

Show button

Shows a menu from which you can select the types of nodes to be shown.



Objects	Choose which object types to show. Select Clear Below to turn off all filters.
Invert Shown	Reverse the filters so visible objects are invisible and invisible objects are visible.
Show All	Turns off all filters in the Show menu.
Show selected types	Shows only object types of the same type as the current selection.
Create Entry	Lets you save the current filter with a name.
Delete Entry	Lets you delete a saved filter.
Show Auxiliary nodes	Shows node types that are normally not shown because they are rarely needed (such as underworld nodes).
Auxiliary nodes	Lets you set what nodes are considered "auxiliary".

Hypershade tab toolbar

View as icons

 Displays the swatches as icons with text.

When viewing swatches as icons, you can select the size: Small, Medium, Large or Extra Large.

View as list

 Displays the swatches as text only (a much more compact display). In large scenes with many shading elements (materials, textures, lights, for example), this option improves the performance of Hypershade.

When viewing swatches as a list, you can select the size: Small, Medium, Large or Extra Large.

View as small/medium/large/extra large swatches

 small

 medium

 large

 extra large

Customize the Hypershade by selecting the ideal size for your swatches.

Tip	You can dolly in the Hypershade tabs (using the Alt + the right mouse button, or Alt + the left mouse button and the middle mouse button) to flip through the swatch sizes.

Sort by name

 Sorts the swatches alphabetically (A-Z).

Sort by type

 Groups swatches together by type (Blinn, or Phong, for example), and sorts the groups alphabetically (A-Z).

Sort by time

 Sorts swatches by their creation date and time (oldest to newest).

Sort in reverse order

 Use this option to reverse the sorting when you've specified Name, Type, or Time.

Tip	You can access the features on this toolbar via the View menu of the Hypershade menu bar.

Hypershade menu bar

Hypershade menus

Use the Hypershade menus to perform tasks such as creating render nodes, creating, renaming or removing tabs, graphing the shading network for a selected node, opening the Attribute Editor or Connection Editor, or customizing the displaying of your swatches, and so on.



Hypershade menu bar

File > Import (Hypershade)

Opens the Import dialog so you can choose a Maya scene file, such as a file containing a shader, to import into Maya.

File > Import Selected Scene Files

Reads elements from another file and loads them into the current file.

File > Import Selected Image Files

Select an item from the drop-down list to choose how to import image files.

For a description of the mapping options, see "Mapping methods" on page 36.

Include Placement

When on, Maya automatically creates a texture placement node when you create a texture render node. The default setting is on.

File > Export Selected Network

Exports the selected item into a new file. The file browser opens to its best guess directory, but you can browse to any directory, or cancel, before exporting.

Edit > Delete (Hypershade)

Deletes the selected node(s). When you delete a node from Hypershade, Maya deletes it from the session.

Edit > Delete Unused Nodes

Deletes nodes not assigned to geometry or particles.

Edit > Delete Duplicate Shading Networks

Deletes redundant shading networks.

Edit > Delete All by Type

Deletes all nodes of the type you select, whether they are assigned or not.

Edit > Revert Selected Swatches

Reverts the selected swatches to their default shapes.

Edit > Select All by Type

Highlights all the node swatches you select from this menu.

Edit > Select Objects with Materials

Highlights all the node swatches from objects that have materials assigned to them.

Edit > Select Materials from Objects

Highlights all the node swatches from selected objects. For example, if you want to know which materials are used by objects A,B,C, you can first select objects A,B,C, then select this menu item to select materials related to A,B,C. Objects A,B,C will no longer be selected. The initial objects you selected can be a normal object or a group or faces of a polygon geometry.

Edit > Duplicate (Hypershade)

Duplicates the selected node or shading network. To duplicate a node without its network, select the node and select Edit > Duplicate > Without Network. To duplicate a node and connect it to the same network (in effect, sharing the network), select Edit > Duplicate > With Connections to Network.

For more information on shading networks, see ”About shading networks” on page 23.

Edit > Convert to File Texture

Converts (renders) illumination, shadow, shading, and textures to a file texture you can use as a texture map.

See ”Baking illumination and color” on page 147 for more information.

For more information on a similar function in a metal ray renderer, see ”Lighting/shading > Batch Bake (mental ray)” on page 246.

Convert to File Texture (Maya Software) > ❐

Note	For Convert to File Texture to work properly for polygonal objects, the polygons must have (UV) values, and unique (UV) values across the surface. Otherwise, the result may not be what you expect.

Anti-alias

If on, sharp, jagged edges within the solid texture are blurred or anti-aliased.

Background Mode

When converting a file to a texture, occasionally some of the pixels along texture edges are missed. As a result parts of the geometry are not properly covered and the background color shows through. In the Background Mode drop-down list, there are three options for managing this situation.

Shader Default A default color is applied to the background. The color may be a blend of the shader colors. This option is intended for compatibility with previous versions of Maya. This is the default.

Custom Color Specify a color to apply to the background using the Background Color field. For example, this can be useful if you want to import the file texture into image editing software and want a special key (color) to select the background for processing.

Extend Edge Color Looks at the neighboring pixels' colors to determine the appropriate background color to extend the texture pattern at the edges. This option provides the best quality in some situations.

Tip In the Hardware Texturing Options window, set the Texture Filter option to Filtered for best quality. Set the Texture Filter option to Unfiltered to see the potential artifacts.

Fill Texture Seams

If the selected UV space contains boundaries, these boundaries may appear as black stripes in renderings that use the baked textures. This occurs when the texture is sampled so close to a boundary that the filter picks up values (generally black) from outside the desired space.

This setting artificially extends the boundaries by a small amount to alleviate this problem. It is measured in texels (pixels of texture). Typically, the filter is only a few texels in diameter and can only reach as far as its radius into these boundary spaces, so a value of 1 or 2 is usually enough.

Note The Convert to File Texture algorithm consists of two passes by default. The first pass samples the color of the inside of triangles; the second pass extends the sampled color slightly in each direction along the polygon border to fill texture seams. Game developers, or other users who have no room for overscanning, can disable the second pass by turning the Fill Texture Seams attribute off.

Bake Shading Group Lighting

Bakes the lights that illuminate the selected surface into a new image file when you convert a texture or material into an image file. The new image file is lit by the same lights linked to the surface in the scene. (This option is ideal for color matching.)

Bake Using Virtual Plane

This option lets you create an image map for layered shaders or other non directly supported shading networks properly without having the image cropped based on an object's UVs. This bakes out a sample image using a virtual plane with UVs from 0,0 to 1,1 square.

Bake Shadows

Specifies whether to compute shadows when baking lighting. Disk-based shadow maps are used. Only lights with depth map shadows turned on (Use Depth Map Shadows in a light's Attribute Editor) are used.

Bake Transparency

Specifies whether to compute transparency when baking lighting. Bake transparency samples both the color and transparency of the shading network—Maya sets the alpha channel of the file texture to correspond to the sampled transparency's result. Transparency is not computed by default.

Double Sided

Turn this option off when baking lighting or shadows. If on, normals that are needed when sampling the shading network are flipped to face the camera. (You can use this option when baking a shading network's lighting to light both sides of the surface).

Note Turning Double Sided on makes the conversion dependent on the camera which may be undesirable in some cases, particularly with baked lighting and shadows.

UV Range

Specifies the amount of the surface to sample in UV space. For example, if you select one or more faces on a polygonal object, instead of sampling the whole surface, only the selected faces are sampled.

Note	UV Range can be used in conjunction with selected polygonal faces.

Default	For NURBS surfaces, Maya samples the entire surface. For polygonal and SubDivision surfaces, Maya samples an area from [0,0] to [1,1].
Entire Range	Samples the entire surface (for example, a polygonal cube is sampled from [-1,0] to [2,4]). A place2dTexture node is created and connected to the file texture.
User Specified	Turn on to enable the U and V Min/Max options (see next). A place2dTexture node is created and connected to the file texture.

U Min/Max, V Min/Max

Slider values specify how much to stretch the sampling range of U or V components. Maya stretches the sample region to fit the output image size within the [0,0] to [1,1] sampling range.

X Resolution, Y Resolution

The horizontal and vertical resolution of the image file, measured in pixels. The slider range is 1 to 512. The default value is 256.

File Format

Lets you choose a format in which to save the file texture. The default is Maya IFF.

Available Image Formats

- Alias Pix (als)
- Cineon (cin)
- DDS (dds)
- EPS (eps)
- GIF (gif)
- JPEG (jpg)
- Maya IFF (iff)
- PSD (psd)
- PNG (png)
- RLA (rla)
- SGI (sgi)

- Avid® Softimage® (pic)
- Targa (Tga)
- TIff (tif)
- Tiff16 (tif)
- Windows Bitmap (bmp)
- Sony Playstation® (tim)

Edit > Convert PSD to Layered Texture

Retains the layers in your PSD file and converts file to corresponding layered texture.

Edit > Convert PSD to File Texture

Converts a PSD file to a file texture and compresses all layers into one. See "Convert a PSD node to a file texture" on page 93.

Edit > Create PSD Network

Creates a PSD texture network you can use as a texture map. See Texturing > Create PSD Network.

Edit > Edit PSD Network

Once you've created a PSD Network, you can edit it. When you edit a PSD Network you can add or remove attributes in the Edit PSD Network Options window. See "Edit PSD Networks" on page 93 for more information.

Edit > Update PSD Networks

When you modify a PSD file (in Adobe Photoshop) that is connected to a Maya PSD node (in Maya), you can update (refresh) the image in Maya to show the modifications immediately. See Texturing > Update PSD Networks.

Edit > Create Container

New

Adds a new container node to the Work Area and adds any selected nodes to it. Node connections between the original nodes are maintained. In addition, unique attributes can be added to the container node.

Edit > Remove Container

New

Removes the selected container node from the Hypershade. Nodes within the selected container revert back to their original node connections.

When the container node is nested within one or more other container nodes, the nodes within the container being removed are moved into the parent container node one level up in the hierarchy.

Edit > Collapse Container

New

Reduces the selected container node to the size of one node. All nodes within the container are not displayed but instead represented by the container node. The container node is easily differentiated from other nodes in the Input/Output connections graph via its thick, round-cornered border.

Edit > Expand Container

New

Increases the display size of the selected container node(s) to display all of the nodes within.

Edit > Edit Texture

Opens your default image editor and allows you to edit the texture.

Edit > Test Texture

See ”Test textures (and texture ranges)” on page 96.

Edit (Hypershade) > Test Texture > ❐

These are descriptions of the options in the Test Texture Options dialog box.

x/y resolution

The x and y resolutions in the tested texture.

Edit > Render Texture Range

See ”Test textures (and texture ranges)” on page 96.

Edit (Hypershade) > Render Texture Range > ❐

These are descriptions of the options in the Render Texture Range Options dialog box.

Image name

The name of the resulting rendered images. Images are written to the images directory of the active project. The file name will be padded (for example, checker.0001.iff).

File Format

The file format of the rendered texture images.

x/y Resolution

The x and y resolutions for the rendered texture images.

Start Frame

The first frame number used for the sequence.

End Frame

The last frame number used for the sequence.

By Frame

The number of frames to advance between the Start and End frames (see "Render Settings window" on page 265 in the *Rendering* guide for details).

Padding

The number of padding digits in the number (for example, 001 is 3, 0001 is 4, and so on).

Auto load range in image viewer

Launches and loads the newly created sequence into image viewer.

View > Frame All

Frames all nodes, and zooms to the largest icon size to accommodate as many swatches as possible (if not all swatches) in the Hypershade view.

View > Frame Selected

Frames the selected node(s), and zooms to the largest icon size that allows all the selected nodes to appear in the Hypershade view. The first selected node appears at the top of the view.

View > As Icons

Displays the swatches as icons with text.

When viewing swatches as icons, you can select the size: Small, Medium, Large or Extra Large.

You can also access this feature from the Hypershade tab toolbar.

View > As List

Displays the swatches as text only (a much more compact display). In large scenes with many shading elements (materials, textures, lights, for example), this option improves the performance of Hypershade.

When viewing swatches as a list, you can select the size: Small, Medium, Large or Extra Large.

You can also access this feature from the Hypershade tab toolbar.

View > As Small/Medium/Large/Extra Large Swatches

Customize the Hypershade by selecting the ideal size for your swatches.

You can also access these features from the Hypershade tab toolbar.

Tip	You can dolly in the Hypershade tabs (using the Alt + the right mouse button, or Alt + the left mouse button and the middle mouse button) to flip through the swatch sizes.

View > By Name

Sorts the swatches alphabetically (A-Z).

You can also access this feature from the Hypershade tab toolbar.

View > By Type

Groups swatches together by type (Blinn, or Phong, for example), and sorts the groups alphabetically (A-Z).

You can also access this feature from the Hypershade tab toolbar.

View > By Time

Sorts swatches by their creation date and time (oldest to newest).

You can also access this feature from the Hypershade tab toolbar.

View > Reverse Order

Use this option to reverse the sorting when you've specified Name, Type, or Time.

You can also access this feature from the Hypershade tab toolbar.

Bookmarks > Create Bookmark

New

Store the current node arrangements as a quick reference. Select options to name the bookmark, otherwise the bookmark is assigned a default name.

Tips

- Bookmarks are interchangeable between the Hypergraph and the Hypershade. Bookmarks saved in the Hypergraph can be opened in the Hypershade and vice versa. For more information about the Hypergraph, see "Hypergraph overview" on page 382 in the *Basics* guide.
- Scene hierarchy graphs cannot be displayed in the Hypershade. Therefore, any scene hierarchy bookmarks created from the Hypergraph will appear greyed out under the Bookmarks menu in the Hypershade.
- The Bookmark menu is only enabled if you are in the Work Area of the Hypershade. You can also right-click in the Work Area and select the Bookmark functions from the marking menu.

Bookmarks > Bookmark Editor

New

Edit the stored bookmark.

Create menu

Use the Create menu options to create the rendering nodes that you desire. Alternatively, you can select Create > Create Render Node or use the Create bar to access various materials, textures, lights and utility nodes.

For more information regarding Maya render nodes, see:

- "About surface materials" on page 311
- "About displacement material" on page 350
- "About volumetric materials" on page 351
- "About 2D textures" on page 367
- "About 3D textures" on page 389

- ”About environment textures” on page 408
- ”Layered texture” on page 418
- ”Sources of direct light” on page 16
- ”About General Utilities” on page 472
- ”About Color Utilities” on page 499
- ”About Switch Utilities” on page 505
- ”Image plane” on page 454
- ”Optical FX Attributes” on page 156

For information regarding mental ray for Maya render nodes, see:

- ”mental ray for Maya nodes” on page 423

Create > Create Render Node

Opens the Create Render Node window from which you can select rendering nodes. Icons representing the nodes are displayed under each tab.

Create Render Node window

The Create Render Node window provides access to materials, textures, lights, and utility nodes you can create and customize in Hypershade. Icons representing the nodes are displayed under each tab.

To open the Create Render Node window, from the Hypershade, select Create > Create Render Node.

Note	The Create Render Node window has the same functionalities as the Create Bar in the Hypershade.

Materials

With Shading Group

When on, Maya automatically creates a shading group when you create a material node. See ”About shading networks” on page 23 for more information about the Shading Group.

If you create a material with a shading group, Maya automatically selects all surfaces assigned to that shading group, or when you select a surface, Maya automatically selects the shading group to which it is assigned.

To display the shading group icon in Hypershade, click the Graph > Input and Output Connections button.

Surface Materials

Describe the physical appearance of surfaces. See ”About surface materials” on page 311 for more information.

Volumetric Materials

Describe the physical appearance of phenomena which occupy a volume of space (for example, fog or particles). See "About volumetric materials" on page 351 for more information.

Displacement Material

Change the surface of geometry. When viewed in silhouette, you can see the displacement of the surface. See "About displacement material" on page 350 for more information.

Textures

With New Texture Placement

Click the Textures tab to display this option. When on, Maya automatically creates a texture placement node when you create a texture render node. The default setting is on.

Normal

See "Mapping methods" on page 36.

As projection

See "Mapping methods" on page 36.

As stencil

See "Mapping methods" on page 36.

2D Textures

2D patterns that simulate various types of surface materials by using either an image file (File texture) or a computer graphic procedure. See "2D and 3D textures" on page 29.

3D Textures

3D patterns that simulate solid materials (for example, wood or marble) using a computer graphic procedure. When you map a 3D texture to a surface, the surface appears to be carved out of the material. See "2D and 3D textures" on page 29.

Environment Textures

Simulate 3D spaces using a series of image files (Env Ball, Env Cube, and Env Sphere textures) or using a computer graphic procedure (Env Chrome and Env Sky textures). See "Environment textures" on page 30.

Other Textures (Layered Texture)

Provides a quick way to layer attributes. You can create a texture consisting of two or more of the textures already existing in the scene and control how they are composited. See "Layered textures" on page 30.

Lights

Surfaces are illuminated by light rays directly emitted from these light sources. Using the attributes and properties associated with lights, you can simulate many different types of real-world light sources and special effects.

For more information about light sources and their attributes, see "Sources of direct light" on page 16 in the *Lighting* guide.

Utilities

General Utilities

Utilities provided to enhance and blend various attributes and textures. See "General utilities" on page 205.

Color Utilities

Utilities provided to color correct and enhance texture colors. See "Color utilities" on page 206.

Switch Utilities

Several objects can share shading characteristics, and you can define unique characteristics for each object on an object-by-object basis. See "Switch utilities" on page 207.

Particle Utilities

For more information about particles, see "Overview of particles" on page 21 in the *Dynamics* guide.

Image Planes

Control the appearance and placement of an image plane. You can assign a texture or image file to an image plane to create a background for the scene.

For more information, see "Create, edit, or position an image plane" on page 127.

Glow Utilities

Glows, halos, or lens flares optical effects are produced when a light shines directly into the camera. You can add an optical FX to any light.

For more information, see "Glows, halos, and lens flares" on page 21 in the *Lighting* guide.

mental ray

For information regarding mental ray for Maya render nodes, see "mental ray for Maya nodes" on page 423.

Tabs > Create New Tab

Opens a window in which you can set options for the new tab you want to create.

For more information on Hypershade tabs, see "Hypershade tabs" on page 282.

Tabs > Move Tab Up, Down, Left, Right

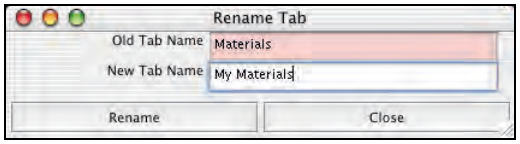
Select a tab then select one of these options to move the tab up, down, left, or right.

For more information on Hypershade tabs, see "Hypershade tabs" on page 282.

Tabs > Rename Tab

Opens a window in which you can assign a new name for a selected tab.

For more information on Hypershade tabs, see "Hypershade tabs" on page 282.



Tabs > Remove Tab

Select a tab then select this option to remove it.

For more information on Hypershade tabs, see "Hypershade tabs" on page 282.

Tabs > Revert to Default Tabs

Removes new tabs and reverts to the default organization.

For more information on Hypershade tabs, see "Hypershade tabs" on page 282.

Tabs > Show Top Tabs Only

Shows only the top tabs (containing the rendering components).

You can also access this function from the "Hypershade main toolbar" on page 286.

Tabs > Show Bottom Tabs Only

Shows only the bottom tab (Work Area tab).

You can also access this function from the "Hypershade main toolbar" on page 286.

Tabs > Show Top and Bottom Tabs

Shows both top and bottom tabs.

You can also access this function from the "Hypershade main toolbar" on page 286.

Tabs > Current Tab

For more information on Hypershade tabs, see "Hypershade tabs" on page 282.

When the current tab is a disk tab or the default Projects tab, the following options become available:

Show Directories Only

The tab displays only the directory lists.

Show Files Only

The tab displays only the file icons.

Show Both

The tab displays both the directory lists and the file icons in a split panel.

Refresh File Listing

The tab refreshes the list display.

Refresh Selected Swatches

The tab refreshes the selected swatches. This applies to disk tabs in Hypershade.

Refresh All Swatches

The tab refreshes all the swatches. This applies to disk tabs in Hypershade.

Tip	In the Project and custom disk tabs of Hypershade you can right-click a file and select Refresh Swatch to refresh that file swatch.

Generate Swatch Files for Current Images

When you navigate to a directory containing images in a disk tab (such as the default Projects tab), Hypershade reads each image file from disk and displays a swatch that represents it. Reading every image file and creating a swatch takes time, particularly for directories containing large image files and, or many image files, or over a network.

Once the swatches for the image files are created and displayed, you can use the *Generate Swatch Files for Current Image*s menu item to save them. Now, every time you navigate to the same directory in Hypershade, the display updates much faster since Hypershade no longer has to read each image file—it can read the saved swatches instead.

The swatch files are saved in a `.mayaSwatches` subdirectory of the directory containing the images, and the names of the swatch files correspond to the names of the image files. For example, for an image file called `earth.tif`, the .mayaSwatches subdirectory contains a file called `earth.tif.swatch`.

Notes

- Because the swatch files are saved in a subdirectory, you need write permissions to the directory to successfully generate swatch files for current images.
- Refreshing a swatch may require some processing time due to the disk/network access times.

Graph > Graph Materials on Selected Objects

Displays the shading group networks of selected objects.

For more information on shading networks, see "About shading networks" on page 23.

Graph > Clear Graph

Clears the Hypershade Work Area tab of all nodes and shading networks.

For more information on the Work Area tab, see "Work Area tab (bottom tab)" on page 284.

Graph > Input Connections

Displays only the input connections of selected nodes. See also "Input Connections" on page 57.

For more information on render node connections, see "Render node connections" on page 25.

Graph > Output Connections

Displays only the output connections of selected nodes. See also "Output Connections".

For more information on render node connections, see "Render node connections" on page 25.

Graph > Input and Output Connections

Displays the input and output connections of the selected nodes. See also ”Input and Output Connections” on page 57.

For more information on render node connections, see ”Render node connections” on page 25.

Graph > Show Previous Graph

Displays the graph you were previously working on, in the Work Area. This is similar to a web browser’s Back button. The hotkey for this menu item is “[“.

For more information on the Work Area tab, see ”Work Area tab (bottom tab)” on page 284.

Graph > Show Next Graph

Displays the graph you were working on next (if you showed one or more previous graphs) in the Work Area. This is similar to a web browser’s Forward button. The hotkey for this menu item is “]“.

For more information on the Work Area tab, see ”Work Area tab (bottom tab)” on page 284.

Graph > Add Selected to Graph

Adds the selected nodes to the Work Area. This is helpful for adding non-rendering nodes, such as shape and transform nodes, to the Hypershade for use in shading networks.

For more information on the Work Area tab, see ”Work Area tab (bottom tab)” on page 284.

Graph > Remove Selected from Graph

Removes the selected nodes from the Work Area. This helps to reduce clutter.

For more information on the Work Area tab, see ”Work Area tab (bottom tab)” on page 284.

Graph > Rearrange Graph

Rearranges the nodes in the current layout to view all nodes and shading networks without overlaps.

For more information on the Work Area tab, see ”Work Area tab (bottom tab)” on page 284.

Window > Attribute Editor

Displays the Attribute Editor for the selected node.

Window > Attribute Spread Sheet

Displays the Attribute Spread Sheet and loads it with the selected nodes so you can edit attributes for all nodes at one time.

For more information on the Attribute Spread Sheet, see "Attribute Spread Sheet" on page 337 in the *Basics* guide.

Window > Connection Editor

Displays the Connection Editor (without pre-loading nodes in either column).

For more information on the Connection Editor, see "Render node connections" on page 25.

Window > Connect Selected

Displays the Connection Editor with the selected node loaded in the Outputs column.

For more information on the Connection Editor, see "Render node connections" on page 25.

Options > Create Bar

Contains options for managing the Create Bar display: Show Create Bar, Display Icons and Text, Display Icons Only. See "Hide, resize or customize the Create bar" on page 49.

For more information on the Create Bar, see "Hypershade window" on page 278.

Options > Display (Work Area Only)

Use these to control the display of shapes and transforms. See "Hide shape and transform nodes in Hypershade" on page 47.

No Shapes

No shapes are displayed in Hypershade.

All Shapes except Shading Group members

Only shapes that are directly connected to shading nodes are shown. Shapes that are only connected to the Shading Group are not shown.

All Shapes

All shapes are displayed, including ones that are connected to the Shading Group only for the purpose of expressing set membership.

Transforms

Transforms are shown.

The display of transform nodes in Hypershade is controlled by the "Transforms" flag in the object's Attribute editor.

Options > Keep Swatches at Current Resolution

Does not rerender swatches in the Hypershade when you zoom. This is helpful if a scene is complex and there are many swatches in a Hypershade layout.

Options > Clear Before Graphing

If Clear Before Graphing is on, selecting a node already in the Work Area and performing a Graph Input and, or Output Connections operation clears the Work Area before the new graph is drawn. If Clear Before Graphing is off, the same workflow adds the nodes in the new graph to the Work Area without removing previous nodes.

12 Shading Nodes

Reference Material nodes - Maya software

Surface materials

About surface materials

Overview of surface materials



The Material tab in the Create bar and the Create Render Node window includes Surface Materials, Volumetric Materials, and Displacement Materials. For more information on surface materials, see "Surface material" on page 28.

Some attributes (such as color and transparency) are common to most surface materials and are described in "Common surface material attributes" on page 312.

Some attributes are shared among many surface materials, are therefore grouped separately from the Common surface attributes and are described in "Shared surface material sections" on page 339.

Surface material-specific descriptions are provided in this section under the material name.

Common surface material attributes

The following attributes are common to most surface materials.

For material-specific specular shading attributes, see the particular material. For example, for information on the specular shading attributes of the Anisotropic material, see "Anisotropic" on page 317.

Type

The material's basic type (such as Blinn or Phong).

When you change a material's type, only those attributes common to both types retain their previous values or settings. For example, if you change the material type from Blinn (which has a Color attribute and a Specular Color attribute) to Lambert (which has a Color attribute but no Specular Color attribute), the Color setting is preserved, but the Specular Color setting is lost.

Color

The default material color.

Transparency

A material's color and level of transparency. For example, if the Transparency Value is 0 (black), the surface is totally opaque; if the Transparency value is 1 (white), the surface is totally transparent.

To make an object semi-transparent, set the Transparency color to a shade of grey or to the same color as the material Color. The default value is 0 (black).

If you change Transparency from the default black (0), the background of the material's Hypershade swatch becomes a checkered pattern. This is a visual aid and is not rendered.

For more information, see "Transparency" on page 20.

Note If the material has specular highlights the transparency setting do not affect the highlights. So if you are trying to make an object disappear by animating the transparency attribute, you may also have to animate the specular highlight attributes.

Ambient Color

Set to black by default, which means it does not affect the material's Color. As the Ambient Color becomes lighter, it affects the material's Color by lightening it and blending the two colors. If there are ambient lights in the scene, the color and brightness of those lights is used to control how much the ambient color contributes to the final color of the material.

Incandescence

Note	Although incandescence makes a surface appear to glow, it does not actually act as a source of light in the scene.

The color and brightness of light that a material appears to be emitting. (Incandescent objects do not illuminate other objects.) For example, to simulate lava, use a bright red Incandescence. The default color value is 0 (black).

Tip	Use a little Incandescence for vegetation to make it look organic.

Bump Mapping

Makes the surface appear rough or bumpy by altering surface normals (during rendering) according to the intensity of the pixels in the bump map texture. A bump map does not actually alter the surface. A silhouette of the surface appears smooth.

For more information about bump mapping, see ”About surface relief” on page 111.

Diffuse

Gives the material the ability to reflect light in all directions. The Diffuse value acts like a scaling factor applied to the Color setting—the higher the Diffuse value, the closer the actual surface color is to the Color setting. The valid range is 0 to infinity. The slider range is 0 (no light is reflected in all directions) to 1, but you can type in a higher value. The default color value is 0.8.

Translucence

Gives the material the ability to transmit and diffuse light. Light falling on a translucent surface is first absorbed beneath the surface, and then diffused in all directions. If set to 0, the default, no light shows through the object. If set to 1, all the light shows through. The default value is 0.

Tip	Use Translucence to simulate clouds, fur, hair, marble, jade, wax, paper, leaves, flower petals, or frosted light bulbs.

Notes

- The Translucence value of a surface lit by a non-shadow-casting light is zero or infinite (all non-zero values).
- If the scene combines a translucent surface with a shadow casting spotlight, faint grid-like artifacts may become visible. If this happens, increase the spotlight Dmap Filter Size or lower the Dmap Resolution.
- For high values of Translucence, lower Diffuse accordingly to avoid washout.
- A surface's actual translucence is based on the illumination it receives from lights, and is not related to its transparency. However, as an object becomes more transparent, its translucent (and diffuse) illumination gets dimmer.
- Ambient lights have no effect on translucent (or diffuse) illumination.

Translucence Depth

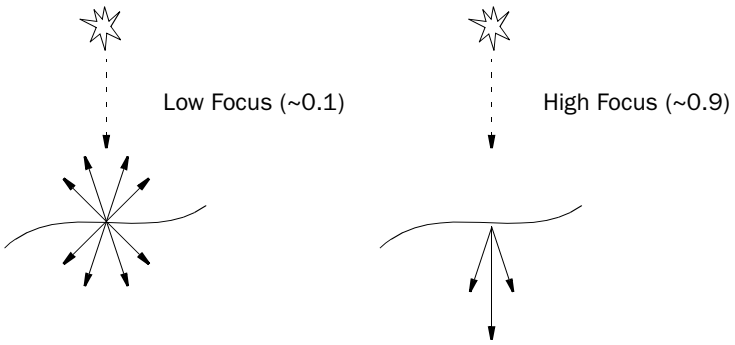
Simulates the way light diffusely penetrates through translucent objects. For example, when light shines on one side of the object, the other side is partially illuminated. This can be used for effects such as clouds, fur, hair, marble, jade, wax, paper, leaves, and so on. (To see this effect, turn on raytraced shadows for the light shining on the object.)

Translucence depth is based on worldspace. If it is set to 0 (the default), no light shows through the object. If set to 10, light penetrates through the surface, 10 units past the point where the object is in shadow.

Tip To see the effects of translucence depth, set the transparency to a non-zero value. If the surface is supposed to be opaque, set the transparency to a very small value, such as 0.0001.

Translucence Focus

The Translucence Focus value controls how much translucent light is scattered depending on the direction of the light.



For example, use a high value for very thin materials, such as wax paper or steam, where most of the light is scattered over a small angle relative to the light's direction. The object looks brightest with the light source directly behind it.

Note	When a spotlight is used to light an object with a translucent material, the light does not scatter past the light's cone of influence, even if Translucence Focus is lowered.



Use a mid-range focus value for items such as leaves. The leaves glow when backlit, but do not wash out when lit from the front.







Use a low focus value for thicker objects, such as wax. To compensate for the added light and avoid a washed out result, lower the diffuse value, or lower the overall color (which also affects ambient lighting).



Tip	Lower the color value for very shiny objects that have a bright specular component.

Common surface material Specular Shading attributes

For more information about specular highlights, see ”Specular highlight (shine)” on page 21.

For material-specific specular shading attributes, see the particular material. For example, for information on the specular shading attributes of the Anisotropic material, see ”Anisotropic” on page 317.

Specular Color

The color of shiny highlights on the surface. A black Specular Color produces no surface highlights. The default color value is 0.5.

Tip	For glossy plastic surfaces, use a whitish Specular Color. For metallic surfaces, use a Specular Color similar to the surface color.

Reflectivity

Gives the surface the ability to reflect its surroundings or the Reflected Color (similar to Specular Roll Off). The valid range is 0 to infinity. The slider range is 0 (no reflections) to 1 (clear reflections). The default value is 0.5.

Reflectivity values for common surface materials are car paint (0.4), glass (0.7), mirror (1), chrome (1).

Notes	• For the Anisotropic material, you must turn off Anisotropic Reflectivity to change this value. • Real reflections are only calculated during raytracing. • If you are doing raytracing and you want other objects in the scene to be seen in reflections, then for those objects you must ensure the Visible In Reflections attribute is turned on in the Render Stats section of the Attribute Editor. (It is on by default.)

Reflected Color

Represents the color of light reflected from the material. When raytracing, Maya multiplies the color with the light color reflected mirror-like from the surface. This can be used to tint a reflection.

If you are not raytracing, you can map an image, texture, or environment map to the Reflected Color attribute to create fake reflections, which is faster and uses less memory than raytracing. This is called *reflection mapping*. For more information on reflections, see ”True reflections” on page 135.

Anisotropic

Is a material (shader) that represents surfaces with grooves, such as a CD, feathers, or fabrics like velvet or satin. The appearance of specular highlights on an Anisotropic material depends on the properties of these grooves and their orientation. The Specular shading attributes (shiny highlights) determine the direction of the grooves as well as their properties.

An *isotropic* material (such as Phong or Blinn) reflects specular light identically in all directions. If you spin an isotropic sphere, its specular highlight remains still.

An *anisotropic* material reflects specular light differently in different directions. If you spin an anisotropic sphere, its specular highlight changes, depending on the direction of the grooves.

You can set attributes of Anisotropic materials to control the appearance of highlights, determine the orientation and spread of grooves, set the roughness and reflectivity, and reduce spherical abnormalities (fresnel index).

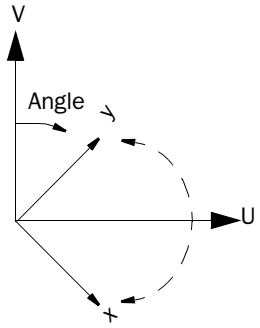
You can find this material in the Create bar.

Specular Shading attributes (Anisotropic)

Control the appearance of specular highlights on a surface.

Angle

Determines the orientation of the grooves. The range is 0.0 (default) to 360.0. Use to determine the X and Y direction for non-uniform specular highlight.



Spread X/Spread Y

Determines how much the grooves spread out in the X and Y directions. The X direction is the U direction rotated counter-clock-wise by the specified Angle degrees. The Y direction is perpendicular to the X direction in UV space.

For Spread X, the range is 0.1 to 100.0 and the default is 13. For Spread Y, the range is 0.1 to 100.0 and the default is 3.0

Large values correspond to surfaces which vary smoothly in the X or Y direction. Small values correspond to surfaces with fine structure. When increased, the specular highlight in the X or Y direction shrinks in size—when decreased, the specular highlight spreads out.

When the Spread X value is equal to the Spread Y value, the surface becomes isotropic—equally smooth in all directions. When the Spread X value is more than the Spread Y value, the surface is smooth in the X direction and rough in the Y direction.

For example, when a surface such as a piece of cloth whose fibers run along the X direction is rendered, the highlights non-uniformly spread out with more highlights along the Y direction.

Roughness

Determines the overall roughness of the surface. The range is 0.01 to 1.0. The default is 0.7. Smaller values correspond to smoother surfaces and the specular highlights are more concentrated. Larger values correspond to rougher surfaces and the specular highlights are more spread out—similar to being diffused.

Fresnel Index

A *fresnel* is a flat lens consisting of a number of concentric rings that reduces spherical abnormalities. The Fresnel Index value computes the fresnel factor that connects the reflected light wave to the incoming light wave. For instance, the Fresnel Index for water is 1.33. Values range from 1.0 to 20.0.

Specular Color

See "Common surface material Specular Shading attributes" on page 316.

Reflectivity

See "Common surface material Specular Shading attributes" on page 316.

Reflected Color

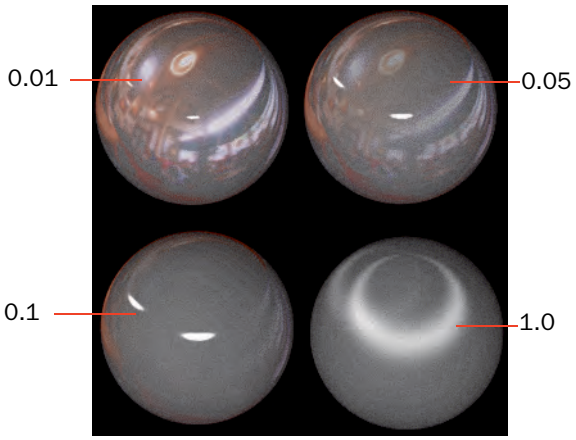
See "Common surface material Specular Shading attributes" on page 316.

Anisotropic Reflectivity

If on, Maya automatically calculates Reflectivity as a fraction of Roughness. Reflectivity is on by default.

If off, Maya uses the specified Reflectivity value for the environment map (mapped on the Reflected Color attribute), similar to how the Phong and Blinn materials work.

In the following, Anisotropic Reflectivity is on, an environment is mapped on the Reflected Color, and the Roughness is set to 0.01, 0.05, 0.1, and 1.0 (from very smooth to very rough).



Blinn

Is a material (shader) that is particularly effective at simulating metallic surfaces (for example, brass or aluminum) which typically have soft specular highlights.

Note	Blinn is the most computationally expensive of the three common materials: Lambert, Phong, and Blinn.

You can set attributes of Blinn materials to control the size of shiny highlights and the ability of the surface to reflect its surroundings.

You can find this material in the Create bar.

Tip	The soft highlights on Blinn surfaces are less likely to exhibit artifacts or flickering for thin highlights than the harder highlights on Phong surfaces. Use the Blinn surface material for surfaces with bump or displacement maps to reduce highlight artifacts or flickering.

Specular Shading attributes (Blinn)

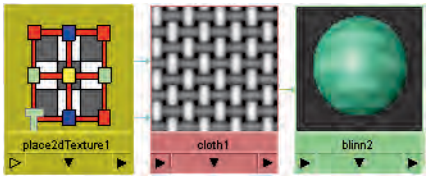
Eccentricity

Controls the size of shiny highlights on the surface. The valid range is 0 (no highlight) to 0.999 (broad highlight, not very shiny surface). A value of 0.1 produces a small highlight (very shiny surface). The default value is 0.3.

Specular Roll Off

Gives the surface the ability to reflect its surroundings (the environment, other surfaces) or the Reflected Color, when viewed at oblique angles. The slider range is 0 to 1. The default value is 0.7.

To help visualize the effect of Specular Roll Off in a Blinn material swatch, assign a texture to the Reflected Color.



Tip	Use a Specular Roll Off value of 0.3 to simulate a wet surface (for example, wet paint).

Specular Color

See "Common surface material Specular Shading attributes" on page 316.

Reflectivity

See "Common surface material Specular Shading attributes" on page 316.

Reflected Color

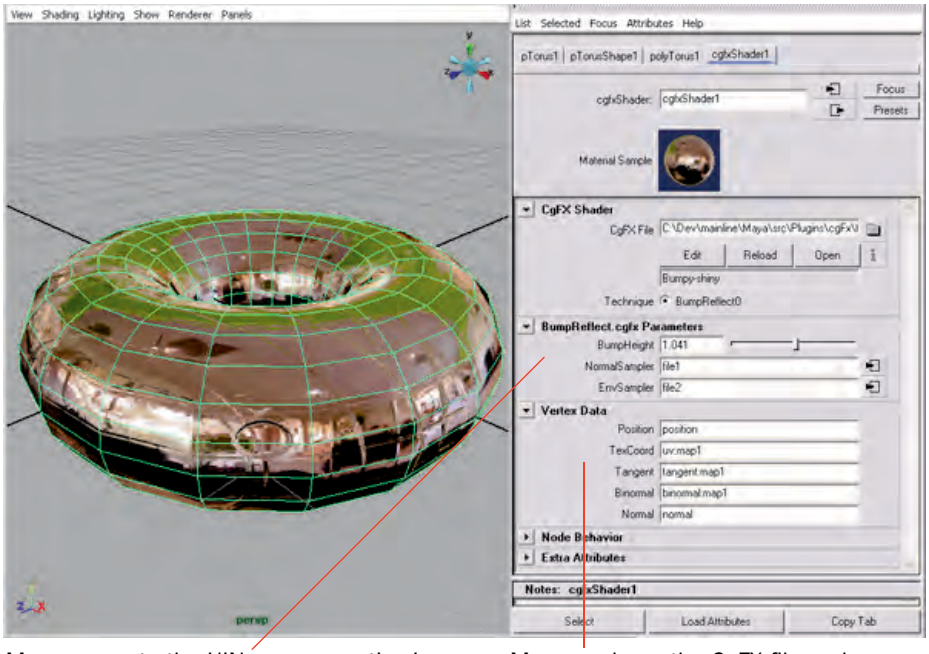
See "Common surface material Specular Shading attributes" on page 316.

CgFX Shader

New

Before you can create a CgFX shader, you must first load the CgFX plug-in. See "Work with CgFX shaders" on page 98 for more information.

Shader provided by nVidia



Maya respects the UIName semantics in the CgFX file and exposes these as shader parameters.

Maya analyzes the CgFX file and exposes the varying parameters here. Use the right-click menu to populate these parameters.

Writing a CgFX shader

Maya supports Cg version 1.5.

CgFX examples are shipped with the Maya software. You can find these examples at:

- (Windows) `<drive>:\Program Files\Autodesk\Maya8.5\presets\CgFX\examples`
- (Mac OS X) `/Applications/Autodesk/Maya8.5/Maya/Contents/presets`
- (Linux) `/usr/autodesk/maya8.5/presets/CgFX/examples`

Varying parameter packing

In Maya 8.5, you can pack multiple mesh inputs into a single varying parameter register. For example, you can pack two sets of UV coordinates into a single float4 register.

The following is a sample workflow:

1. The following vertex shader input structure shows a packed `float4` that needs to contain 2 UV sets in a single varying parameter:

```
struct appdata
{
    float3    Position: POSITION;
    float4    UVs:      TEXCOORD0;
};
```

2. Create a second structure that describes the elements that should be packed into this input. To enable Maya to locate this second structure, its name must match the name of the original varying parameter (in this case, `UVs`).

   In this example, this auxiliary structure informs Maya that the original `float4` parameter should be assembled on the fly from two `float2` inputs: one named `UV1`, and one named `UV2`. This structure is not used by the shader itself - it simply tells Maya how to assemble the data for this input.

```
struct UVs
{
    float2 UV1;
    float2 UV2;
};
```

3. Because Maya knows that this is a packed input, it presents the artist with an interface to the underlying data (`UV1` and `UV2`) rather than the final packed structure (`UVs`). You can now optimize and reorganize the varying parameter register assignment without breaking any existing shader bindings in scenes using the shader.

   For more information, see `UVPacking.cgfx` as an example.

Note	Where the data assigned to a structure element is too large for the Cg data type specified (for example, a position with (x, y, z) coordinates is passed into a `float2` value), the first n values will be used to populate the value, and any subsequent elements will be ignored (for example, x and y will be passed in, and z will be ignored).

Other CgFX shader features

Time semantic

Maya supports parameters that vary by time. See `MrWiggle.cgfx` for an example of a shader that moves with time.

Matrix semantic

You can specify matrices in your CgFX shader. Maya supports all matrix semantics keywords.

Transparent CgFX shaders

Maya supports rendering of transparent CgFX shaders. Maya detects whether the blending state is enabled in the first pass. If blending is enabled, Maya uses the Object Transparency Sorting or Polygon Transparency Sorting options in the viewport to correctly render the transparent shader.

Known limitations

Known limitations for the CgFX shader include:

- Maya only supports `.cgfx` files and not `.cg`
- Pre and post effects (for example, full-screen effects)
- Pass scripting
- Cg Interfaces
- Time semantic: When using a shader that moves with time, you must refresh the scene in order to see the animation, for example, by tumbling the camera.

Lambert

Is a material (shader) that represents matte surfaces (such as chalk, matte paint, unpolished surfaces) with no specular highlights.

The initial (default) shading group uses a special Lambert surface material. Do not modify it; instead, create and apply a new Lambert material.

Find this material in the Create bar.

You can set attributes of Lambert materials to control its appearance. See ”Common surface material attributes” on page 312.

Layered Shader

For more information on layered shaders, see ”Layered shaders” on page 28.

Find this material in the Create bar.

Layered Shader Attributes

Transparency

Sets the material's transparency. By default the material is semi-transparent.

Compositing Flag

Composites the layers in either Layered Shader node or Layered Texture node. Each mode calculates the transparency flag differently.

For more information, see "Layered textures with the Layered Shader node" on page 28.

Layered Shader The color and transparency are processed and passed together to the Layered Shader. In other words, transparency is taken into consideration to modify the color before the color is reported to the Layered Shader.

Layered Texture Color and transparency are passed separately to the layered shader. In other words, color is reported to the Layered Shader with no consideration of the transparency setting; transparency is passed as a separate channel. The color and transparency are then composited. However, this can lead to dark halos where the negative space of the alpha channel is represented.

Hardware Shading Attributes

Hardware Color

Helps you distinguish the objects assigned to a layered shader in the views.

Ocean Shader

You can find this material in the Create bar.

For information on Ocean Shader, see "Ocean shader and texture" on page 93 in the *Fluid Effects* guide.

Phong

Is a material (shader) that represents glassy or glossy surfaces (such as car moldings, telephones, bathroom fittings) with a hard specular highlight.

You can find this material in the Create bar.

Tip	The soft highlights on Blinn surfaces are less likely to exhibit roping or flickering for thin highlights than the harder highlights on Phong surfaces. Use the Blinn surface material for surfaces with bump or displacement maps to reduce highlight roping or flickering.

Specular Shading attributes (Phong)

Cosine Power

Controls the size of shiny highlights on the surface. The valid range is 2 to infinity. The slider range is 2 (broad highlight, not very shiny surface) to 100 (small highlight, very shiny surface), though you can type in a higher value. The default value is 20.

Specular Color

See "Common surface material Specular Shading attributes" on page 316.

Reflectivity

See "Common surface material Specular Shading attributes" on page 316.

Reflected Color

See "Common surface material Specular Shading attributes" on page 316.

Phong E

Is a material (shader) that is a simpler version of the Phong material. The specular highlights on Phong E surfaces are softer than those on Phong surfaces, and Phong E surfaces render faster.

You can find this material in the Create bar.

Specular Shading attributes (Phong E)

Roughness

Controls the specularity focus.

Highlight Size

Controls the amount of specular highlight.

Whiteness

Controls the specular highlight color. The default is white, but you can choose any color. You can also map a texture to this value.

Ramp Shader

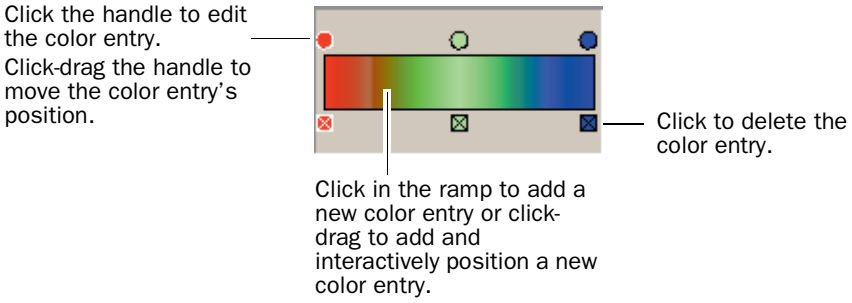
You can find this material in the Create bar.

The Ramp Shader is a material (shader) that you can use for extra control over the way color changes with light and the view angle. You can simulate a variety of exotic materials and tweak traditional shading in subtle ways.

All the color-related attributes in the Ramp Shader are controlled by ramps (gradients). Graphs let you avoid complex shading networks by making certain looks, like toon shading, easier to achieve.

You can set the many attributes of the Ramp Shader to control the appearance of objects.

Each color entry in a ramp has a circular color handle above the ramp, and a square color icon below the ramp. The active color has a white border around its color handle and icon.



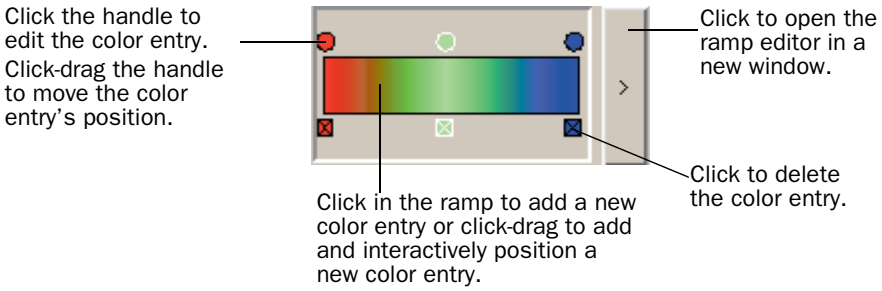
Tip	To make a shader that avoids linear artifacts on the edge where a surface turns away from the light try the following: Diffuse = 0 Translucence = 1 Color: two entries, black at 0.5 and surface color at 1.0 With Linear Interpolation, this should be the same as a normal lambertian falloff. Using Smooth Interpolation makes the linear shading artifacts disappear.

Working with the Ramp Editor in a separate large window

Click the arrow on the right side of the ramp to open the Ramp Editor in a larger window. In this window, you can edit the interpolation method, the selected color, and the color entries. In addition, you can check and uncheck the Vertical box to toggle between a vertical or horizontal layout for your Ramp Editor.

Checking the vertical box alters the size of your Ramp Editor. Once you check the vertical box, the Ramp Editor automatically adjusts to a suitable size.

When you save your scene, Maya also saves the layout that you have chosen for your Ramp Editor and the corresponding window size.





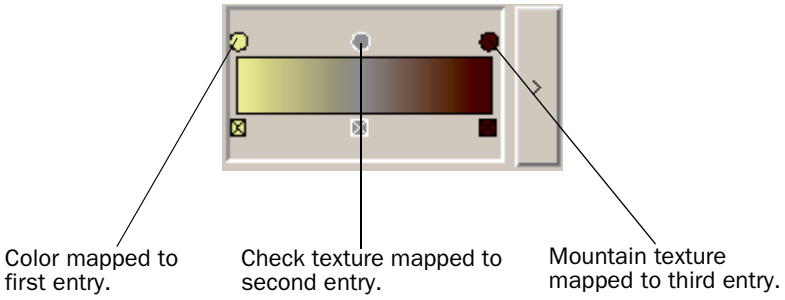
Applying textures to a ramp

In addition to color entries, you can also add texture entries to the ramp. You can map a texture to both the position or the color of a ramp.

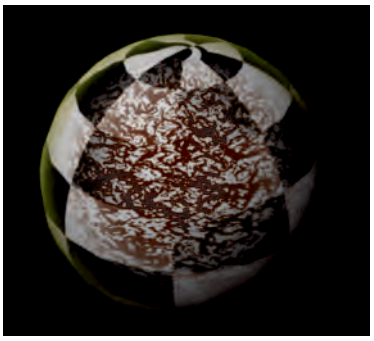
Mapping the color of a ramp index to a texture

Click the handle above the ramp and then click  beside the Selected Color attribute in the Attribute Editor (or Ramp Editor) to map a texture. You can map textures to your ramp in both the Ramp Editor and within the Attribute Editor. However, you only see the effect of the texture in the material sample swatch and in the shader icon (in the hypershade), not in the Ramp Editor.

Consider the following example. Three entries have been entered into the ramp, the first a color entry, the second a check texture, and the third, a mountain texture.



The rendered result illustrates the surface color transitioning (ramping) from a yellow color to a checkered texture to a mountain texture.



Mapping the position of a ramp index to a texture

You can map the position of a ramp index to a texture to achieve interesting effects. Using this technique, you can create variations within the color boundaries of a ramp. For example, you can make the boundary between two colors a blurry, noise-like pattern using the noise texture. Alternatively, you can experiment with the settings to create complex effects such as natural looking watercolors, or making the gradient more blurry in some areas and sharper in others.

Click the handle above the ramp to select it. Right-click the Selected Position attribute in the Attribute Editor (or Ramp Editor) and choose Create New Texture to map a texture.

After you have mapped a texture to the position of a handle, the position field becomes locked (the text box appears yellow). The position is now fully defined by the texture that you have chosen.

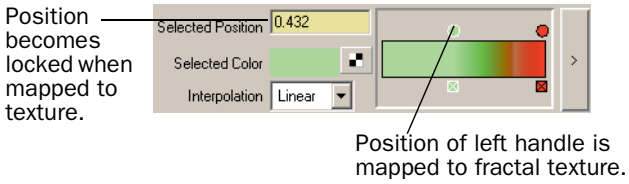
To alter the position of the handle, expand the Color Balance section of the texture in the Attribute Editor. Increase or decrease the Alpha Offset value.

To alter the effect of the texture, increase or decrease the Alpha Gain value.

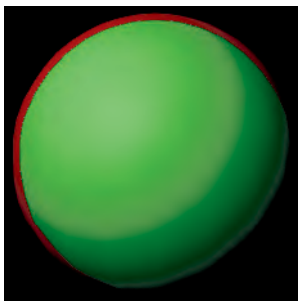
For more interesting effects, you can also alter the Interpolation method of the ramp in the Attribute Editor. See ”Interpolation” on page 330 for more information.

You can map textures to your ramp in both the Ramp Editor and within the Attribute Editor. However, you only see the effect of the texture in the material sample swatch and in the shader icon (in the hypershade), not in the Ramp Editor.

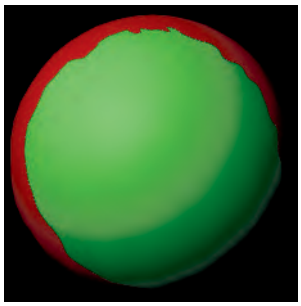
Consider the following example. Two color entries have been entered into the ramp, the first of which has its position mapped to a fractal texture.



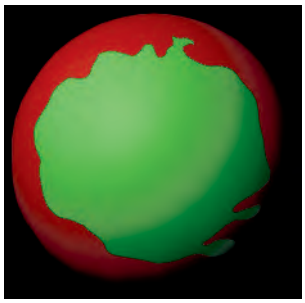
Increase the alpha gain to create variations in the color boundary of the ramp. The effect of the fractal texture is more pronounced as the alpha gain increases.



Alpha gain = 0.0
Alpha offset = 0.3

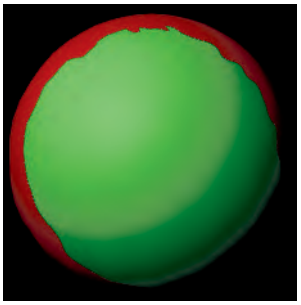


Alpha gain = 0.3
Alpha offset = 0.3



Alpha gain = 0.6
Alpha offset = 0.3

Change the position of the handle by increasing or decreasing the alpha offset.

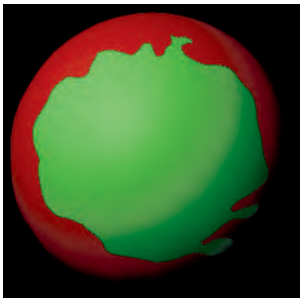


Alpha Gain = 0.3. Alpha Offset = 0.3

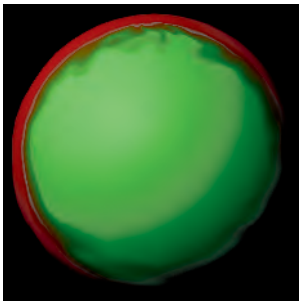


Alpha Gain = 0.3. Alpha Offset = 0.8

Create interesting effects (e.g. increase blurriness) by changing the interpolation method.



Interpolation method = None
Alpha gain = 0.6; Alpha offset = 0.3



Interpolation method = Linear
Alpha gain = 0.6; Alpha offset = 0.3

Color

The basic color of the surface.

Selected Position

Position of the active color entry in the ramp.

Selected Color

The color of the active color entry.

Interpolation

Controls the way colors blend in the ramp. Select an option from the drop-down list: None, Linear, Smooth, Spline. The default is Linear.

None There is no interpolation; the different colors show up as distinct bands in the final texture.

Linear The values are interpolated linearly in RGB color space.

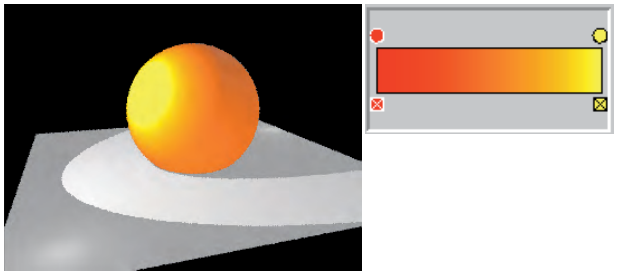
Smooth The values are interpolated along a bell curve, so that each color on the ramp dominates the region around it, then blends quickly to the next color.

Spline This takes into account neighboring indices for a smoother effect.

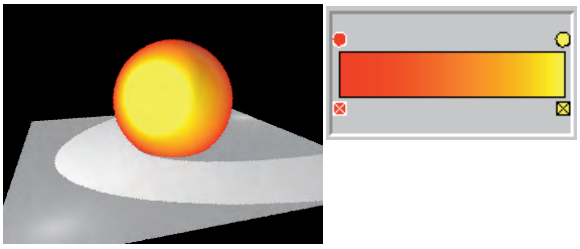
Color Input

Determines how the color is spread over the surface. Select an option from the drop-down list: Light Angle, Facing Angle, Brightness, Normalized Brightness. The default is Light Angle.

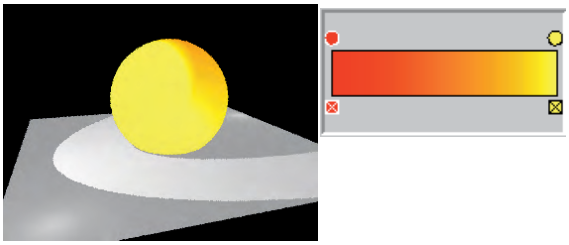
Light Angle The position along the ramp is determined by the angle of the light with the surface normal. The right side of the ramp is the color where the normal points directly towards the light. The center of the ramp represents the point at which the surface normal is perpendicular to the light. The left side is the color where the normal faces directly away from the light. The color values to the left of the ramp center is not be visible unless the shader has some translucency. This takes into account all lights in the scene.



Facing Angle The position along the ramp is determined by the angle of the surface with the view direction. The right side of the ramp is the color where the surface normal faces the camera. The left side is the color where the surface normal is perpendicular to the camera.



Brightness The total light brightness is used to index the ramp. This can be used to create cartoon style shading by using a ramp with stepped values. The right side of the ramp is the output color where the brightness of the diffuse and translucent lighting is 1.0 or greater. The left side is the output color where the brightness is zero.



Normalized Brightness The Normalized Brightness option is similar to the standard Brightness option, but the total light is normalized. Changing the overall light intensity does not affect shading. This option is useful for Toon shading where you may want the color band spacing to be relatively fixed, even when the lighting setup may be complex.

Transparency attributes

Controls how transparent or opaque the material is, as well as the transparency color. Black, the default, is completely opaque and white is completely transparent. You can set it to any level in between. If there is more than one index in the ramp then the transparency value varies with the facing angle.

For descriptions of the attributes, which are the same as the Color attributes, see "Color" on page 330.

Incandescence attributes

Makes a material appear as if it were emitting light, such as lava or a phosphorescent moss. The default color is black, which has no effect on the surface. If there is more than one index in the ramp the incandescence value varies with the facing angle.

For descriptions of the first few attributes, which are the same as the Color attributes, see "Color" on page 330.

Ambient color

See "Ambient Color" on page 312.

Bump Mapping

See "Bump Mapping" on page 313.

Diffuse

See "Diffuse" on page 313.

Forward Scatter

Controls how much of the light is diffusely scattered along the light direction. At a value of 0 the light is scattered uniformly in a lambertian fashion, which is good for most surfaces. Some materials, such as skin, scatter the light more along the forward direction so values larger than zero may help in simulating these materials.

Translucence

See "Translucence" on page 313.

Translucence Focus

See "Translucence Focus" on page 314.

Translucence Depth

See "Translucence Depth" on page 314.

Specular Shading attributes

Specularity

Controls how bright the specular highlights are. It is a simple multiplier of the specular color.

Eccentricity

Controls how big the specular highlights, or hot spots, are. For more information, see "Specular Shading attributes (Blinn)" on page 320.

Specular Color

Is the color of the specular reflections, also called hot spots, on the material. The final color of a specular reflection is a combination of the Specular Color and the color of the light. By making the Specular Color brighter or dimmer, you can control the brightness of the specular reflections on an object. If there is more than one ramp index, the specular color varies based on the brightness of the highlight.

For descriptions of the attributes, which are the same as the Color attributes, see "Color" on page 330.

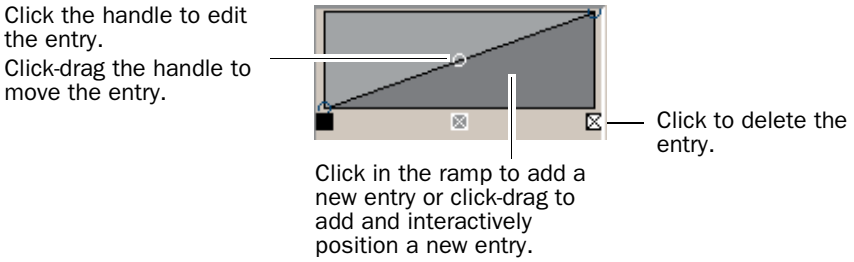
Specular Roll Off

This modulates or scales the intensity of the specular highlight. The facing ratio is the input to the graph. Making the graph slope down to the right simulates the fresnel effect, where objects with a low refractive index are more reflective towards the edge (where the normal is perpendicular to the view). Water and wax both have a relatively low refractive index, thus this can help simulate the look of a waxed car finish, an ocean surface or a wet

object. The horizontal dimension of the graph represents the brightness of specular reflections and the vertical represents the facing angle with the view.

Specular Rolloff does not affect the reflections produced when you render using raytracing.

Tip	To get a wet look, such as wet paint, make the edges more reflective.



Selected Position

The active value on the x-axis of the ramp graph.

Selected Value

The active value on the y-axis of the ramp graph.

Interpolation

Controls the way values are calculated in the ramp. Select an option from the drop-down list: None, Linear, Smooth, Spline. The default is Smooth.

None

There is no interpolation; the different colors show up as different bands in the final texture.

Linear

The values interpolated linearly in RGB color space.

Smooth

The values interpolated along a bell curve, so that each value on the ramp dominates the region around it, then blends quickly to the next value.

Spline

This takes into account neighboring indices for a smoother effect.

Reflectivity attributes

This functions in the same manner as specular rolloff, but modulates the environment and reflected color instead of specularity. It also affects raytrace reflections. Reflectivity is used to make an object reflect light and its environment like a mirror. Set to 0 for no reflection. Increase the value to make brighter reflections. Note that brighter reflections hide more of the base surface color. This attribute is only meaningful if there is a reflection map, or if you are raytracing the render.

Note	If you are doing raytracing and you want other objects in the scene to be seen in reflections, then for those objects you must ensure the Visible In Reflections attribute is turned on in the Render Stats section of the Attribute Editor. (It is on by default.)

For descriptions of the Selected Position, Selected Value, and Interpolation attributes, see "Specular Roll Off" on page 333.

Environment attributes

Defines a simple sky to ground environmental reflection using a ramp. The left of the ramp is the top of the sky and the right is the bottom.

For descriptions of the Selected Position, Selected Color, and Interpolation attributes, see "Color" on page 330.

Reflected Color

Affects the color of light reflected from the material. You can map an image, texture, or environment map to this attribute in order to make fake reflections, which are less expensive than raytracing. This is called reflection mapping. Reflection mapping and raytracing may be used together, in which the reflection map is used as background, and raytraced reflections appear in the foreground.

Shadow Control attributes

Shadow Mode

Specifies the shadow mode to be used. Select one of the following options from the drop-down list:

Normal	Use this mode when you want the shadow color to be the same as the lowest color position in the ramp shader. The Shadow Color and Shadow Threshold options are not available in Normal mode.
Shaded Color	Use this mode when you want to specify a particular shadow color that has gradients based on the background or objects that the shadow is cast on. You can set the shadow color with the Shadow Color attribute.

Constant Color Use this mode when you want to specify a particular shadow color that has a consistent, solid color throughout the shadow regardless of the background or objects that the shadow is cast on. You can set the shadow color with the Shadow Color attribute.

Shadow Color

Specifies the color of the shadow when using the Shaded Color or Constant Color modes.

Shadow Threshold

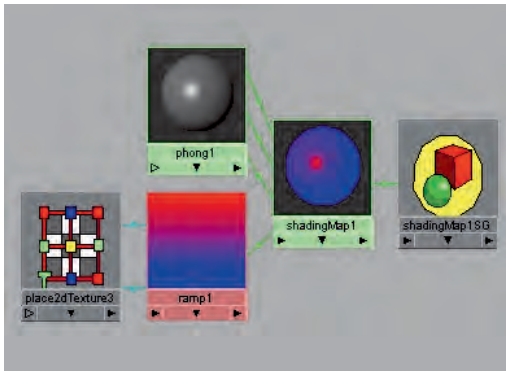
Specifies the spread of your shadows. The higher the setting, the smaller the spread of your shadow. A value of 1 results in no shadow rendered.

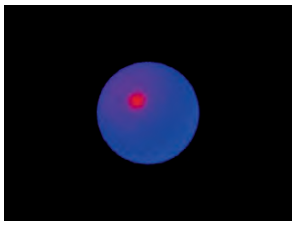
Shading Map

Is a material (shader) that lets you create various non-photorealistic shading effects, such as cartoon-style materials, or highlight threshold values in a rendered image.

Use a Shading map shader with a basic shader (such as a Phong or Blinn shader) and a texture (such as a Ramp or File texture).

For example, you can create a material that renders the bright areas of an object (the areas facing light) as red, and the dark areas of an object (facing away from light) as blue. For this example, you would use a Shading Map shader, a Lambert shader, and a Ramp texture. The Ramp texture is red on the top, and blue on the bottom. Connect the Lambert shader's Out Color attribute to the Shading Map shader's Color attribute. Connect the Ramp texture's Out Color attribute to the Shading Map shader's Shading Map Color attribute.





Shading maps work like a post process: the regular shader computes a color for each point on the surface, then the shading maps shader replaces this color with another color. This mapping is based on two things; the brightness of the original color, and the hue of the original color.

You can find this material in the Create bar.

Shading Map Attributes

Color

Select a color, or map with a shader to this attribute. This provides the base color to which the shading map is applied.

Shading Map Color

Defines the color of the material. The default is gray.

Map Options

Map Function U, Map Function V

Their defaults are Hue and Value, respectively, but other options include Saturation, Red, Green, Blue, and RGB Average. Map Function U specifies how the input color is used when looking up in the U direction of the shadingMapColor. Map Function V specifies the input color is used when looking up in the V direction of the shadingMapColor.

Surface Shader

Is a material (shader) that is a wrapper node, which means that you can connect any keyable attribute to this shading group, and then connect the shading group to an object. For example, you can connect an object's Translate Position to a Surface Shader's Out Color attribute to determine the object's color by the object's position.

Find this material in the Create bar.

Surface Shader Attributes

Out Color

The color of the material. The default is black.

Out Transparency

The transparency of the material. The default is black (opaque).

Out Glow Color

The glow color of the material. The default is black, without glow.

Out Matte Opacity

Connect another attribute to this option to control the opacity of the material's matte (alpha) channel.

Use Background

You can create custom shadow and reflection passes with the useBackground material which catches shadow and, or reflections.

When the shadow pass is rendered, a black image is created with mask channel that contains the shadow information. A compositor can work with this channel to blur, lighten, darken, and so on, the look of the shadows. When the reflection pass is rendered, an RGB image is created with a white mask in the mask channel.

Find this material in the Create bar.

For more information about the Use Background material as a catcher, see "Shadow catching" on page 25 in the *Lighting* guide.

Use Background Attributes

Specular Color

Defines the material's specular color. If you change this color or assign a texture to it, the reflections in the scene display your changes. For instance, if you map a checker texture to the Specular Color, the reflection appears in a checkered pattern. Drag the slider to set the Specular Color to white if you want to see very clear reflections in the rendered result. The default is gray.

Reflectivity

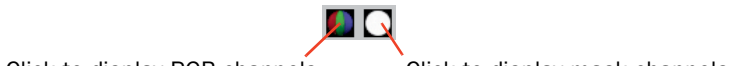
Determines how much of the object's texture reflects on the Use Background material. For instance, if the object is very shiny, increase this value. The default is 0.5.

Reflection Limit

Determines the reflection's distance. The default is 2.

Shadow Mask

Determines the density of the material's shadow mask. If you change this value, the shadow masks becomes darker or lighter, allowing you to better verify the shadows and reflections in the scene when viewing the mask channels in Render View.



The default value is 1.0. If set to 0.0, the shadow does not display.

Matte Opacity

For best results when adjusting these attributes, select the Display Alpha Channel icon in the Render View to view the mask channels when re-rendering the scene.

Matte Opacity Mode

Opacity Gain	Displays both reflections and shadows.
Solid Matte	Adjusts the density of the Use Background material.

Matte Opacity

Use the slider or enter a value to adjust the density of the mask channels.

Shared surface material sections

The following sections of the Attribute Editor provide attributes that are shared between most materials.

Special Effects

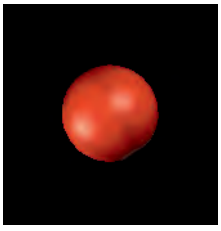
These attributes control the appearance of glows produced from light reflecting off surfaces, or from surface incandescence. Special Effects attributes are available for Anisotropic, Blinn, Lambert, Phong, and PhongE material types. See also "Glow" on page 208 for more information.

Hide Source

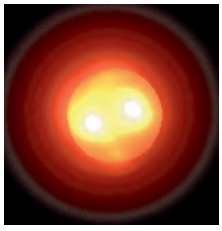
Makes the surface invisible when rendered (if the Glow Intensity value is non-zero) showing only the glow effect. Hide Source is off by default.

Glow Intensity

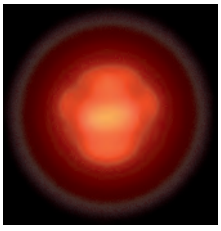
The brightness of the surface glow effect. The slider range is 0 to 1, but you can type in higher values to create a 'blown out' or 'burn in' effect. The default value is 0. Mapping a texture to the Glow Intensity can create very interesting effects. Turn on Hide Source to view the results.



Blinn material, color applied.



Glow Intensity mapped to Bulge texture, Hide Source off.



Result when Hide Source is on.

Matte Opacity

You can control the mask value for individual objects. Matt Opacity attributes are available for Anisotropic, Blinn, Lambert, Layered Shader, Phong, PhongE, Shading Map and Use Background material types.

Matte Opacity Mode

Select from the list of modes in the drop-down list.

For best results when adjusting these attributes, select the Display Alpha Channel icon in the Render View to view the mask channels when re-rendering the scene.

Opacity Gain

This is the default Matte Opacity Mode. This mode produces both reflections and shadows.

The matte channel is first calculated, and then multiplied by the specified Matte Opacity value. The Opacity Gain value is used as a multiplier on the matte value produced by this material.

The Matte Opacity Mode value is also keyable. The Opacity Gain range is from completely invisible to no effect (rendered as usual).



Opacity Gain with a Matte Opacity value of 0.5.

Solid Matte

Solid Matte makes the value of the matte channel constant for the material. The value you specify in the Matte Opacity slider is used, instead of the default value.

Use Solid Matte to adjust the overall density or visibility of the Use Background material.



Solid Matte set to 0.0.



Solid Matte set to 0.5.

Black Hole

When you select the Black Hole mode, the matte channel for the material is set to 0 (fully transparent). This creates a black hole in the alpha output where the object assigned shader renders the matte ‘knocked out’.

In this mode, the Matte Opacity slider is disabled and its value ignored.



Rendered result with Matte Opacity Mode set to Black Hole.

Note	For the Opacity Gain and Solid Matte modes, if an object has non-zero Transparency, objects behind it make their usual contribution to the matte channel's values. This is the difference between setting Matte Opacity to 0.0 in these modes, and choosing the Black Hole mode.

Matte Opacity

This value depends on which Matte Opacity Mode is selected (Opacity Gain or Solid Matte). For example, for Opacity Gain, the Matte Opacity value indicates the multiplier amount for the alpha channel. The default is 1, which means that any opaque material registers an unaffected alpha value.

Any values between 0 and 1 act as a multiplier to the alpha channel value to arrive at modified value. Use the slider or enter a value to adjust the density or visibility of the mask channels.



Opacity Gain with a Matte Opacity value of 1.0.



Opacity Gain with a Matte Opacity value of 0.5.

Raytrace Options

The Raytrace Options attributes control the appearance of a surface during raytracing only.

Raytrace Options attributes are available for Anisotropic, Blinn, Lambert, Phong, and PhongE material types.

Refractions

When enabled, rays that are traced through transparent or semi-transparent objects are refracted, or bent according to the material's refraction index.

Refractive Index

The amount that light rays bend when passing through a transparent object. A Refractive Index value of 1 does not bend light rays at all, so you need to set the index value higher than 1. Refractive Index values for common materials are: glass (1.6), air (1), water (1.333), crystal (2), diamond (2.417). The valid range is 0.01 to infinity. The slider range is 0.01 to 3, but you can type in a higher value. The default setting is 1.6.

Tips

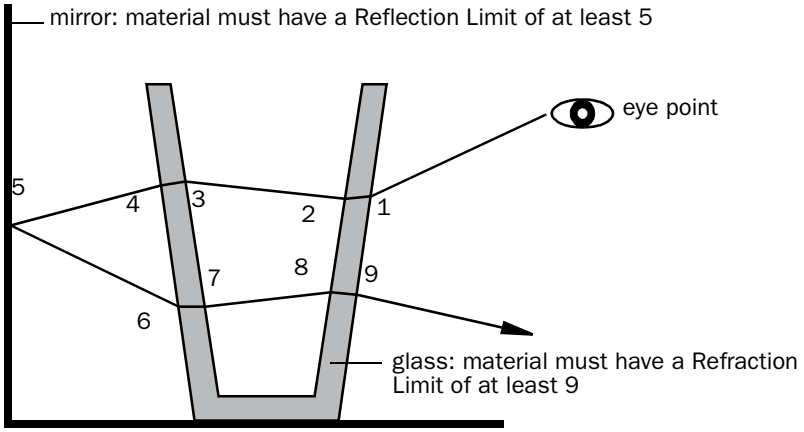
- The material's Hypershade swatch only approximates the effect of the Refractive Index attribute.
- Surfaces must have thickness for Refractive Index to have any effect. If a surface does not have thickness (for example, a plane or face element), set the Refractive Index value to 1.
- For best results, make sure there are suitable objects in the background to be refracted.

Refraction Limit

The maximum number of times the surface allows a light ray to be refracted. For example, if the Refraction Limit value is 10, the surface refracts light rays that have previously been refracted and, or reflected (off itself or off other surfaces) 9 times or less; the surface does not refract light rays that have previously been refracted and, or reflected 10 or more times. The valid range is 0 to infinity. The slider range is 0 to 10. The default value is 6. Increasing this value may significantly increase render times.

You must also consider the Render Settings window Raytracing Refraction attribute too. Maya uses the lower value of the 2. For instance, if your limit is set to 9 on the material and 6 in the Render Settings window, a value of 6 is be used. See also, Reflection Limit

In the following example, a glass sits in front of a mirror.



The number of refractions includes both the entry and exit of a light ray from a surface having thickness.

The physical property Total Internal Reflection (TIR) can make some transparent objects appear not to refract light. This is caused by light rays reflecting inside the thickness of the object. If this occurs, increasing Refraction Limit has no effect because the Reflection Limit is stopping light rays before they can exit the surface. However, because TIR is a real-world property, you may want to keep this effect.

Tip	To simulate realistic looking glass, set the Refraction Limit value to 9 or 10.

Reflection Limit

The maximum number of times the surface allows a light ray to be reflected. For example, if the Reflection Limit value is 4, the surface reflects light rays previously reflected (off itself or off other surfaces) 3 times or less; the surface does not reflect light rays previously reflected 4 or more times. The valid range is 0 to infinity. The slider range is 0 to 10. The default value is 1.

Set the Reflection Limit value according to the material's Reflectivity value. For example, if the Reflectivity value is between 0 and 0.5, set the Reflection Limit value between 1 and 2. If the Reflectivity value is between 0.5 and 1, set the Reflection Limit value between 2 and 5.

High values for Reflection Limit greatly increase rendering time. Test render the scene using various settings, and use the lowest values that give you acceptable results. Even highly reflective surfaces rarely need a Reflection Limit value as high as 10 or more.

You must also consider the Render Settings window Raytracing Reflection attribute too. Maya uses the lower value of the 2. For instance, if your limit is set to 5 on the material and 1 in the Render Settings window, a value of 1 is used. See also Reflection Limit.

Reflection Specularity

This attribute is available for Blinn, Anisotropic, Phong, and PhongE materials.

Reduce this value to avoid highlight aliasing artifacts produced in reflections during raytracing because of very thin or small highlights. Maya adds Reflection Specularity to each material to control the contribution of the specular highlights in reflections. The valid range is 0 to 1. The default is 1 (full contribution).

Light Absorbance

Describes how light-absorbing a material is. A material with an Absorbance of 0.0 transmits completely. The higher the value, the less light passes through.

Transparent materials generally absorb an amount of the light which passes through them. The thicker the material, less light gets through—the thinner the material, more light gets through.

Surface Thickness

The simulated thickness (in world space) of transparent objects created from single surfaces (for example, a NURBS plane, or polygon face).

Using Surface Thickness does not produce the same results as building a surface with actual thickness—the effect works well when the edges of the surface are not visible (for example, closed surfaces, or bounded shapes, like a car windshield).

Shadow Attenuation

Shadows of transparent objects are brighter in the center, simulating a light's focus. A setting of 0 results in constant intensity shadows. The focusing increases as the parameter increases from 0 to 1. The default value is 0.5. The amount of attenuation for a given light ray depends on the angle between the light ray and the surface normal of the transparent object: the greater the angle, the greater the attenuation. To turn off the shadow attenuation completely, set shadow attenuation to 0.

Chromatic Aberration

Different wavelengths of light refract at different angles when passing through a transparent surface during raytracing. Chromatic Aberration only affects light rays as they pass through the second surface of a transparent object (the first exit ray).

mental ray

Irradiance

This is the ability to bounce indirect photons. Use this to map an incoming illumination map, such as one generated using "Lighting/shading > Batch Bake (mental ray)" on page 246. For information about baking in general, see "Baking illumination and color" on page 147.

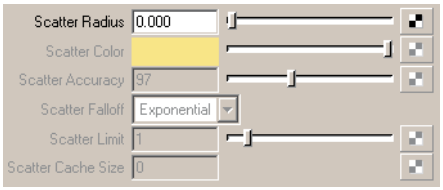
Irradiance Color

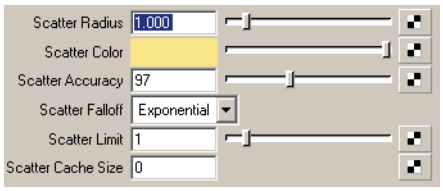
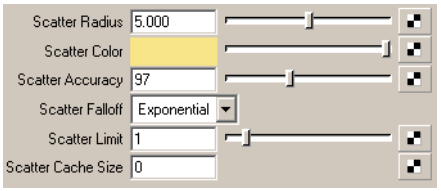
This is the color of bounced photons.

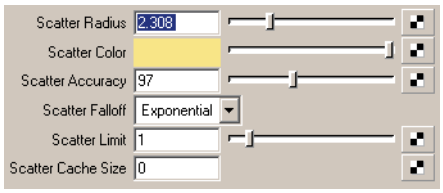
Scatter Radius

Determines how far light scatters under a surface. If the incoming light and the scatter radius are at an equal distance, mental ray assumes that all the light is absorbed by the material. The Scatter Radius attribute is in world space units, and has a default value of 0.

A value of 0 means that scattering is turned off. To set the other scatter attributes, the Scatter Radius must be set to a value greater than 0.

Scatter Attributes	Rendered Image
 Scattering is turned off, because the Scatter Radius value is 0. The material on the model appears solid, hard and flat.	

Scatter Attributes	Rendered Image
 Scatter Radius value is greater than 0, so scattering is turned on and you can adjust the other scattering attributes. The material on the model appears to have a glow beneath the surface, but still appears relatively solid.	
 With the Scatter Radius value set to 5, the effect spreads across the material. The scattering in this image produces too much glow, indicating that the Scatter Radius value is too high.	

Scatter Attributes	Rendered Image
 With the Scatter Radius value set to 2.308, the material resembles a translucent milky plastic. The scattering fades with the falloff of the light and glows along the shadowed edge. Scattering is high in the mandible region because this part of the model is thin, allowing more light to be diffused.	

Scatter Color

Determines the color of the scatter component of the shader. The default color is grey (0.5, 0.5, 0.5), which produces scatter that is the diffuse color of the surface. You can change the scatter color by using the slider, or map the attribute.

Scatter Accuracy

Determines how many samples from within the Scatter Radius are taken to blur the diffuse component of the shader. The default value is 97.

The higher the Scatter Accuracy, the more memory and time used for calculation.

Scatter Falloff

Determines how quickly light diminishes along the scatter path. You can set one of the following values:

- None: Light does not lose intensity when scattering until it reaches the Scatter Radius value. When the light reaches the Scatter Radius value it becomes black.
- Linear: A distance-based scatter falloff where light intensity decreases equally proportionately (linearly) with distance. In this case the falloff is slower than the falloff of real world light.
- Quadratic: A distance-based scatter falloff where light intensity decreases by the square of distance (the same as real world light).

- Exponential: A distance-based scatter falloff where light intensity decreases exponentially to distance.

Scatter Limit

Determines a limit for the total number of refractions and reflections in the current surface point. Scattering can only be calculated if the total number of refractions and reflections in the current surface point are smaller than the Scatter Limit. The default value is 1, and a value of 0 turns scattering off.

Scatter Cache Size

Determines the number of scatter samples that are internally cached to improve efficiency. A value of 0 (default), caches all scatter samples. This method is fast, but uses significant amounts of memory. Any value greater than 0 indicates that scatter samples up to that value are cached. For example, a value of 3 indicates that 3 scatter samples are cached. This method takes more time to complete, but memory consumption is capped.

Reflection/Refraction Blur

Determines the blurriness of the reflection or refraction by calculating the angle (in degrees) between the perfect reflection or refraction direction and the jittered ray direction. A value of 0 creates a perfectly specular interaction; a value of 90, a perfectly diffuse reflection or refraction. Values of 10 to 30 are good starting points.

Reflection/Refraction Blur Limit

Determines the blurriness of secondary reflections or refractions. The higher the Reflection/Refraction Blur Limit, the more the secondary reflections/refractions are blurred.

Reflection/Refraction Rays

Specifies how many rays to use to sample the random deviation from the perfect specular direction. (Blurry reflections and refractions require supersampling because a ray's direction is not precisely determined with this feature. It may deviate (randomly) from the perfect specular direction, within the bounds specified by Reflection/Refraction Blur.)

In general, more rays are required for more blurry reflections or refractions. Other sampling parameters also affect this setting: per-object samples and the *Render Setting*s sample setting supersample in image space. If you increase any of these two settings, you may be able to reduce the number of rays without loss of quality, while significantly improving performance.

Photon Attributes

Set attributes to Derive From Maya, or turn the option off and set remaining attributes, such as Specular Color and Diffuse, so that they are calculated using mental ray. Alternatively, you can change the settings in the Maya sections of the Attribute Editor (Common Material Attributes, and so on) and click Take Settings From Maya to compute the equivalent mental ray values for these attributes.

Hardware Shading

This is not rendered.

Override hardware shading for Lambert, Blinn, Phong, PhongE, and Anisotropic shaders.

Hardware Shader

Plug-in writers can use this to override the hardware display while preserving software rendering.

Hardware Texturing

This is not rendered.

Preview rendered materials and textures in the scene views. You can select specific channels to view and determine the hardware render quality. Hardware Texturing attributes are available for Anisotropic, Blinn, Lambert, Phong, and PhongE material types.

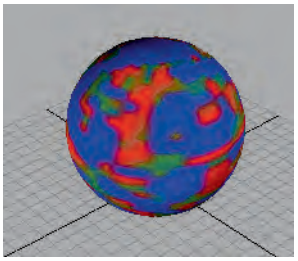
Textured channel

This drop-down list displays the mapped attributes for a texture-mapped material. This can be useful if you map several textures to a material and want to view them one by one. If, for example, you map a Checker texture to a Blinn material's Color attribute, and a File texture to its Specularity attribute, you can select Color from the drop-down list to display only the Checker texture in the view. The top of a material's Attribute Editor also provides tabs for each texture so you can select and edit the texture and watch the results in the view.

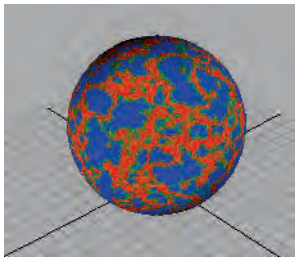
The Combined Textures option can be used to process the entire shader into one texture for hardware display purposes. It allows the entire shader to be previewed on the applied object and not just single channels, for example, color and incandescence.

Texture resolution

Lets you choose to view the textured object with varying degrees of accuracy and clarity.



Default



Highest (256 x 256

Notes	• Some effects, such as bump mapping or glows, cannot be seen in hardware texture mode (in the scene views). Use the Render View or IPR render to view the results. • The Texture Resolution options only improve the quality of the hardware textured image in the scene views. You cannot use these options to improve the test render quality in Render View. Instead, change the Resolution and Anti-aliasing Quality settings in the Render Settings window. Remember: the higher the quality the slower the render time.

Displacement material

About displacement material

For more information on the displacement material, see ”Displacement material” on page 28.

Find this material in the Create bar.

The Displacement Shader only has one attribute.

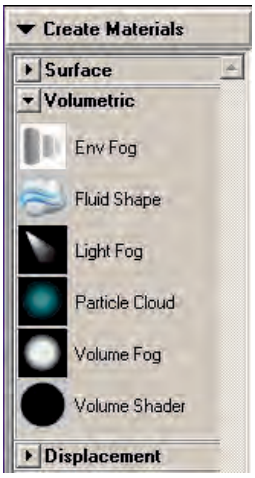
Displacement

The amount by which the surface is displaced. The default displacement value is 0.

Volumetric materials

About volumetric materials

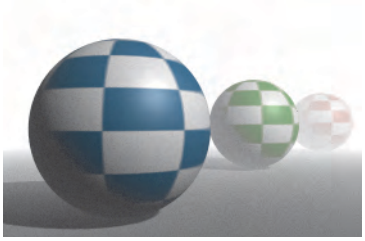
Overview of volumetric materials



The Material tab in the Create Bar (in the Hypershade) and the Create Render Node window includes Surface Materials, Volumetric Materials, and Displacement Materials. For more information on volumetric materials, see "Volumetric material (atmosphere)" on page 28.

- Some attributes (such as Matte Opacity) are common to all volumetric materials and are described in "Common Volumetric material attributes" on page 364.
- Volumetric material-specific descriptions are provided under the material name.

Environment Fog



Simulates the effect of fine particles (fog, smoke, or dust) in the air. These particles affect the appearance of the atmosphere and the appearance of objects in the atmosphere. To simulate particles in the air illuminated by a particular light, use Light Fog (see "Light Fog" on page 359).

There are two types of Environment Fog: Simple Fog (default) and Physical Fog, each of which have specific attributes.

Find this material in the Create bar.

Important!

Environment fog cannot cast shadows. If you want to cast shadows, use Light Fog (see "Light Fog" on page 359). See also Matte Opacity.

Simple Fog

Color

Change to simulate different effects, such as smog (brown fog), or to create the illusion of great distance (blue fog). The default setting is white.

Color Based Transparency

If off, objects obscured by environment fog appear as flat-shaded silhouettes. If on, objects obscured by environment fog are fully shaded, not just flat-shaded silhouettes.

If the fog Color is dark (black), turn off Color Based Transparency or the fog is not visible. Color Based Transparency is on by default.

Saturation Distance

The distance (measured in the scene's linear working unit) from the camera at which environment fog becomes fully saturated (its color value reaches the Color setting). The Saturation Distance affects how much objects within or behind the fog are obscured. The slider range is 0.001 to 200. The default value is 100.

To change the amount that objects within or behind environment fog are obscured, adjust the Saturation Distance attribute and the value of the Color attribute.

Use Layer

If on, you can assign a texture to the Layer attribute to create variations in the density and color of environment fog across the camera's view (that is, in two dimensions). If off, constant density environment fog fills the camera's view. Use Layer is off by default.

Layer

Lets you map a texture to the fog, which gives the effect of patchiness in the fog's density. The most common application is mapping the Density to a 3D texture, like a Solid Fractal, and mapping a Ramp texture to the Layer attribute. Make the Ramp black and white to get a contrast of transparency and opacity. Use Layer is off by default.

Use Height

If on, environment fog exists between the Min Height and Max Height. If off, environment fog fills the camera's view. Use Height is off by default.

Min Height, Max Height

The minimum and maximum height (measured in the scene's linear working unit) from the origin within which environment fog exists (when Use Height is on). If Max Height is less than Min Height, environment fog extends from Min Height to infinity. The slider range is -10 to 10. The default value is -1 for Min Height and 1 for Max Height.

Blend Range

The vertical distance (measured in the scene's linear working unit) over which environment fog gradually fades from full density to zero density. (The edges of the fog are defined by the Min Height and Max Height values.) The slider range is 0 (fog suddenly ends at Min Height and Max Height) to 1 (fog gradually fades at Min Height and Max Height). The default value is 0.

Physical Fog

To access the attributes of Physical Fog, you must turn it on (click the check box under the swatch in the Attribute Editor).

Fog Type

Controls how Maya simulates the fog in the scene. It has a number of different settings, depending on what kind of fog effect you want. This attribute is only available when Physical Fog is turned on.

Uniform Fog	Fog has uniform density in all directions.
Atmospheric	Fog is thickest near the ground, and thins out (decays) as you move upwards.
Sky	Simulates the effect of a whole sky, with fog blending properly at the horizon, and so on. Use this to provide a complete background to a foggy scene. Especially useful for scenes where you can see a long distance.
Water	Simulates the effect of water, scattering light shining in from above. Useful for underwater shots, or for shots where objects are visible in a pool of water from above.
Water/Fog	Uniform Fog appears above the water in the scene.
Water/Atmos	Atmospheric Fog appears above the water in the scene.
Water/Sky	The full Sky Fog simulation appears above the water in the scene.

Fog Axis

Controls the direction the fog simulation uses for the up direction. You can choose any of the X, Y, or Z axes in the positive or negative direction.

This attribute is only available when Physical Fog is turned on, and the Fog Type is not Uniform.

Planet Radius

Available for the Atmospheric, Sky, Water/Atmos, Water/Sky Fog Types.

Fog

Depending on the Fog Type you select, Fog attributes are either available or disabled.

Fog Color

Controls the color of light scattered by the fog. When light passes through air or fog, some frequencies (colors) pass directly through, while other frequencies are scattered. The scattered frequencies give the fog its distinctive color.

Fog Opacity

Controls which light frequencies (colors) are absorbed as they pass through the fog. This affects the way objects in the background seem to be tinted by the fog.

Fog Density

Controls the optical density of vapor in the fog layer. Increase this value to thicken the fog.

Fog Min Height

Controls the height of the bottom of the fog layer. *This attribute is only available when Physical Fog is turned on, and Fog Type is not Uniform*.

Fog Max Height

Controls the height of the fog layer. If the Fog Type is Atmospheric (or Water/Atmos), the density of the fog decreases exponentially from Fog Min Height upwards. If the Fog Type is Sky (or Water/Sky), Fog Max Height is the height of the top of the fog layer. *This attribute is only available when Physical Fog is turned on and Fog Type is not Uniform*.

Fog Decay

Fog Decay controls the rate that the fog *thins out* at higher altitudes. A value of 0.5 makes the fog decay linearly. Values between 0.5 and 1 makes the fog fairly even near the ground, then drop off suddenly at the top. Values between 0 and 0.5 causes the fog to thin out very rapidly near its base. *This attribute is only available when Physical Fog is turned on and Fog Type is not Uniform*.

Fog Light Scatter

Controls how evenly light is scattered in the fog. A value of 1 uniformly scatters the light spread throughout the fog. Lower values make the fog brighter near the position of the sun.

Air

Depending on the Fog Type you select, Air attributes are either available or disabled. The following table lists the Air attributes available for the Fog Type.

Air Color

Controls the color of light scattered by the air. When light passes through air or fog, some frequencies (colors) pass directly through, while other frequencies are scattered. The scattered frequencies give the sky, for example, its distinctive color.

Air Opacity

Controls the light frequencies (colors) absorbed as they pass through the air. This affects the way objects in the background appear to be tinted by the air. For example, objects on the horizon often appear bluish to the naked eye.

Air Density

Controls the optical density of air in the fog simulation. Increase this value to make the air seem denser.

Air Min Height

Controls the height of the bottom of the air layer. *This attribute is only available when Physical Fog is turned on and Fog Type is not Uniform*.

Air Max Height

Controls the height of the air layer. If the Fog Type is Atmospheric (or Water/Atmos), the air density decreases exponentially from Air Min Height upwards. If the Fog Type is Sky (or Water/Sky), Air Max Height is the height of the top of the air layer. *This attribute is only available when Physical Fog is turned on, and Fog Type is not Uniform.*

Air Decay

Controls the rate at which the air thins out at higher altitudes. A value of 0.5 makes the air decay linearly. Values between 0.5 and 1 makes the air fairly even near the ground, then drop off suddenly at the top. Values between 0 and 0.5 cause the air to thin out rapidly near the ground. *This attribute is only available when Physical Fog is turned on and Fog Type is not Uniform.*

Air Light Scatter

Controls how evenly the light is scattered in the air. A value of 1 means that the light is uniformly scattered, and appear s to spread throughout the air. Lower values cause the atmosphere to appear brighter around the sun position. *This attribute is only available when Physical Fog is turned on.*

Water

These attributes become available if the Fog Type is either Water, Water/Fog, Water/Atmos, or Water/Sky.

Water Color

Controls the color of light scattered by the water. When light passes through air or water, frequencies (colors) pass directly through, while other frequencies are scattered. The scattered frequencies give the water its distinctive color. *This attribute is only available when Physical Fog is turned on and Fog Type is set to one of the Water types.*

Water Opacity

Controls the light frequencies (colors) absorbed as they pass through the water. This affects the way objects in the background appear to be tinted by the water. *This attribute is only available when Physical Fog is turned on and Fog Type is set to one of the Water types.*

Water Density

Controls the optical density of water in the fog simulation. Increase this value to make the underwater fog seem more dense. *This attribute is only available when Physical Fog is turned on and Fog Type is set to one of the Water types.*

Water Level

Value represents the water level. *This attribute is only available when Physical Fog is turned on and Fog Type is set to one of the Water types.*

Water Depth

Value represents the water depth. *This attribute is only available when Physical Fog is turned on and Fog Type is set to one of the Water types.*

Water Light Decay

Controls the rate illumination drops off with depth. Set this to 0 if you don't want the light to decay (that is, you don't want it to get darker as it gets deeper). A value of 1.0 results in a linear decay, and higher values darken faster. *This attribute is only available when Physical Fog is turned on and Fog Type is set to one of the Water types.*

Water Light Scatter

Controls how evenly the light is scattered in the water. A value of 1 uniformly scatters the light and it appears to spread throughout the water. Lower values cause the water to appear brighter near the surface from where the light is coming. *This attribute is only available when Physical Fog is turned on and Fog Type is set to one of the Water types.*

Sun

Sun Intensity controls the overall brightness of the sunlight illuminating fog. *Only available when Physical Fog is turned on, and the Fog Type is not Uniform.*

Sun Color

Controls the color of the sunlight illuminating the fog.

Sun Azimuth

Controls the position (angle) of the sun along an imaginary circle that goes around the Fog Axis.

Sun Elevation

Controls the position (angle) of the sun along a line from the horizon to directly overhead. A value of 90 puts the sun directly above (actually, directly in the position pointed to by the Fog Axis) and a value of 0 puts the sun at the horizon.

Clipping Planes

Distance Clip Planes

If set to Fog Near/Far, environment fog exists between the Fog Near Distance and the Fog Far Distance. If set to Camera Near/Far, environment fog exists between the camera's near and far clipping planes. The default setting is Fog Near/Far.

Fog Near Distance, Fog Far Distance

The minimum and maximum distance (measured in the scene's linear working unit) from the camera where environment fog exists when Distance Clip Planes is set to Fog Near/Far.

If Fog Far Distance is less than Fog Near Distance, environment fog extends from the Fog Near Distance to infinity. The slider range is 0 to 200. The default value is 0 for Fog Near Distance and 200 for Fog Far Distance.

Volume Fog

Find this material in the Create bar.

Apply this material to volumetric primitives to create effects such as spherical, conical, or cubicle smoke, fog, or dust. For more information on strategies, see "Create > Volume primitives" on page 243.

Color

Assign a color or map a texture to the volume. To use the color ramp, see "Ramp" on page 381.

Transparency

Represents the amount of the volume's Transparency.

Incandescence

To make a material appear as if it were emitting light, such as lava or a phosphorescent moss. A slight touch of incandescence on vegetable matter, for example, can make the vegetation look alive. The color is black by default, which has no effect on the surface.

Note	Although a surface appears to glow when you apply Incandescence, it does not act as a source of light in the scene. See also Glow Intensity.

Glow Intensity

As you increase this value, the material seems to glow and is surrounded by a faint halo of light. Glow Intensity is different from Incandescence in two ways:

- Glow adds a halo to the surface.
- Maya adds the glow effect at the end of rendering as a post-process; Incandescence just makes the surface appear brighter.

Density

Represents the density or transparency of the fog.

Density Mode

Determines if the density is defined in world space or object space. Object space density preserves the look when an object is scaled.

Illuminated

If on, lights are computed for the fog. The lighting for each volume span is determined by the volume sample's attribute on the geometry.

Light Scatter

The amount the fog scatters light in all directions. As it approaches zero, the fog tends to scatter light directionally, which results in halos around light sources.

Dropoff

Dropoff Shape

Select either the Cone, Sphere, Cube, or Light Cone as a shape used to define an outer boundary to create a soft-edged volume. For example, if rendering a box volume, Cube should match the edges of the volume.

Note	Light Cone is different from Cone—the dropoff (or fade) occurs near the point of the cone.

Edge Dropoff

Defines how suddenly the density falls off near the edges defined by the Dropoff Shape. A value of 0.0 results in a hard edge with no dropoff. A value of 1.0 results in smooth density fade from the edge to the center of the volume.

Axial Dropoff

Defines the density dropoff down the center axis of a cone. Higher values make the fog less dense further from the peak of the cone. (Only works with Cone shapes).

Dropoff Method

Scale Opacity	Multiplies the overall density by the fade value, causing a uniform change in transparency.
Subtract Density	Subtracts the fade value multiplied by the Dropoff Subtract value from the density. Useful when density or transparency is textured. Low density regions become completely transparent, while high density regions are not very affected. This can help preserve the character of a fluffy cloud, for example.

Dropoff Subtract

The maximum amount of density subtracted from the volume when Dropoff Method is Subtract Density. If the volume density is 1.0 and Dropoff Subtract is 1.0, the edge of the volume is completely transparent.

Light Fog

Simulates particles in the air (for example, fog, smoke, dust) illuminated by a particular light. You can add light fog to spot lights or point lights. Light Fog can cast depth map shadows. Environment Fog cannot.

Find this material in the Create bar.

Color

The color of illuminated fog. (The light's Color also influences the color of illuminated fog.) The default color is white.

Density

The density of illuminated fog. The higher the density, the more obscured the objects within or behind the fog. (The density also influences the brightness of illuminated fog.) Color Based Transparency and Fast Drop Off also influence how objects are obscured by illuminated fog. The slider range is 0 to 1. The default value is 1.

Color Based Transparency

If on, the amount that objects within or behind the fog are obscured is based on the Density value *and* the Color value. Objects obscured by the fog are fully shaded, not just flat-shaded silhouettes. If the fog Color is dark (for example, black), turn off Color Based Transparency (otherwise the fog is not visible). Color Based Transparency is on by default.

Fast Drop Off

If off, all objects within or behind the fog are obscured by the same amount, based on the Density value. If on, each object within or behind the fog is obscured by a different amount, based on the Density value *and* the object's distance from the camera (that is, the amount of fog between the camera and the object). Fast Drop Off is off by default.

An object (or part of an object) which has more fog between it and the camera appears more obscured than an object (or part of an object) which has less fog between it and the camera. This is the way real-world fog behaves.

Tip	If Fast Drop Off is on, objects within the fog that are further from the camera may be obscured too much, so you may want to reduce the Density value.

Particle Cloud

Used to achieve effects such as gas or clouds. You can software render particles as thin gas, cloud, thick cloud, blobby surface or tube.

Volume material which can be connected to the volume port of a shading group. The initialParticleSE is a shading group that has a lambert material connected to its Surface port, and a particle cloud material connected to its Volume port. You can connect the particle cloud shading group to a particle emitter to achieve effects such as gas or clouds. You can software render particles as thin gas, cloud, thick cloud, blobby surface or tube.

Color, Transparency, and Incandescence can be set to a fixed value, or texture mapped over the particles' lifetime. If mapped, the V values of the map are mapped onto the particles' lifetime.

Find this material in the Create bar.

Color

The basic color of the particle cloud. The default color is a green-blue.

Transparency

Controls how much you can see through the particle cloud. It is a color, so that you can control the transparency of the red, green, and blue channels separately. To make the cloud more opaque, set transparency to be darker. To make the cloud more transparent, set transparency to be brighter.

Incandescence

Use Incandescence to make the particle cloud brighter, as though it were a light source. By default, Incandescence is black, meaning no glow is added.

Note When Incandescence is turned on, although the particle cloud glows, it does not cast light on other objects in the scene.

Life Color

Determines the color at a particular time in the life of the particle. You can use the Particle Sampler Info node to animate this attribute over a particle's lifetime.

Life Transparency

Determines the transparency at a particular time in the life of the particle.You can use the Particle Sampler Info node to animate this attribute over a particle's lifetime.

Life Incandescence

Determines the incandescence at a particular time in the life of the particle.You can use the Particle Sampler Info node to animate this attribute over a particle's lifetime.

Note Life Color, Life Transparency, and Life Incandescence are driven by the particle age (the texture defines color, transparency, and incandescence, all of which get their UV information from the Particle Age Mapper utility node). The Particle Age Mapper utility node is created automatically at the time the texture is created.

Glow Intensity

Controls how much of a halo-like glow effect is added to the particle cloud. This glow effect is added as a post-process, after the rendering is completed. Glow Intensity is zero by default, meaning that no glow is added.

Transparency

Density

Similar to transparency; it controls how dense the cloud of particles appears to be, and therefore how much of the background can be seen through it. Increase this value to make the cloud more dense.

Blob Map

Specifies a scaling factor applied to the transparency of the particle cloud. You can connect a 3d texture to it in order to give some internal texture or shape to the cloud beyond what it gets from the particles.

Roundness

Controls the noise's irregularity. The smaller the value, the less rounded the shape.

Translucence

Specifies a scaling factor for density that is used only to compute shadows. The larger the translucence value, the more light penetrates. The formula is:

```
density * (1 - translucence)
```

Built-in Noise

Noise

Controls the jitteriness within the particle cloud. If it is set to zero, the cloud looks very smooth and uniform throughout. As the amount of noise increases, the cloud appears *noisier*, like static on a television screen. Noise is set to 0.75, by default.

Noise Freq

Determines the size of the noise artifacts when Noise is turned on. Higher values of Noise Frequency produce smaller, finer artifacts, and lower values produce larger, coarser artifacts. If Noise Frequency is set to zero, that is the same as turning Noise off.

Noise Aspect

Controls the distribution of the noise (when Noise is turned on). It is zero by default, meaning the noise is equally distributed in X and Y. Positive values make the noise run perpendicular to the particle's path. Negative values make the noise run more parallel to the path.

Noise Anim Rate

Specifies a scaling factor that controls the rate of built-in noise changes during an animation.

Solid Core Size

Determines the size of the core, which is the area where the particle is opaque.

Surface Shading Properties

Diffuse Coeff

Controls how much of the light in the scene is reflected from the particles. Most materials absorb some of the light falling on them, and scatter the rest.

The default value is 0.0. If you set this to 1.0, all the light falling on the material is reflected. Use a high value when creating dense clouds. If you set this to 0.0 (the minimum), no light is reflected and no surface shading occurs.

The surface color is modulated by the transparency. This value can be greater than 1.0, so the surface property can still appear even when the material is transparent.

Surface Color

Specifies the basic color of the particle cloud surface (as opposed to the inside of the cloud). Diffuse Coeff must be set to a value greater than 0 to enable this option.

Bump Mapping

Makes the surface appear rough or bumpy by altering surface normals (during rendering) according to the intensity of the pixels in the bump map texture. Diffuse Coeff must be set to a value greater than 0 to enable this option. (A bump map does not actually alter the surface. A silhouette of the surface appears smooth).

Translucence Coeff

Simulates the way light diffusely penetrates through translucent objects. This means that when light shines on one side of the object, the other side is partially illuminated. You can use this to create effects such as clouds, fur, hair, marble, jade, wax, paper, leaves, and so on. If you set Translucence Coeff to 0 (the default), no light shows through the object. If you set Translucence Coeff to 1, all the light shows through. Diffuse Coeff must be set to a value greater than 0 to enable this option.

Surface Shading Shadow

Determines if the surface shading is combined with the pre-illumination, which contains shadows, if enabled (see the Filter Radius attribute description next). Diffuse Coeff must be set to a value greater than 0 to enable this option.

Pre-illumination Controls

Filter Radius

Volumetric particles use pre-illumination, which evaluates the lighting at each particle's center by default. This can sometimes cause popping if the illumination changes too fast in an animation, and is especially noticeable if Surface Shading Shadow is on.

Filter radius lets you filter the pre-illumination results so the value at each particle's center is the average of all the pre-illumination results within the filter radius. Higher values increase render time but produce smoother images.

Volume Shader

Controls the color, transparency, and matte opacity of a volumetric material, such as light fog. This shader lets you connect other attributes and effects directly to its color, transparency, and matte opacity. The Volume Shader can be used with a Spot Light, Point Light, Environment Fog, and particles.

Find this material in the Create bar.

Out Color

Defines the out color of the material. The default is black.

Out Transparency

Sets the out Transparency of the material. The default is black, which is opaque.

Fluid Shape

Find this material in the Create bar.

For information on Fluid Shape, see "Fluid Shape shader as a particle shader" on page 93 in the *Fluid Effects* guide.

Common Volumetric material attributes

The following attributes are common to the Environment Fog and Light fog Volumetric materials:

Matte Opacity

You can control the mask value for individual objects. See Matte Opacity.

Matt Opacity attributes are available for Anisotropic, Blinn, Lambert, Layered Shader, Phong, PhongE, Shading Map and Use Background material types.

Matte Opacity Mode

Click to display the three Matte Opacity Modes from the drop-down list.

Opacity Gain

Default Matte Opacity Mode. The Opacity Gain value is used as a gain control on the usual matte value contribution of a material.

A matte channel is first calculated this way— a value of 1.0 for an opaque surface completely covers a pixel, less if it covers part of a pixel. The value is reduced appropriately for transparent objects, and then multiplied by the specified Matte Opacity value.

The Matte Opacity Mode value is also keyable. The Opacity Gain range is from completely transparent to no effect (rendered as usual).

Solid Matte

Makes the value of the matte channel constant for all pixels covered by these surfaces. The value you specify in the Matte Opacity slider is used.

Black Hole

The matte channel for all pixels covered by the object is set to 0 (fully transparent), even if the object is transparent, and regardless of what is behind the object if it is transparent. This creates a black hole where the object is in the image, to *knock out* the matte. In this mode, the Matte Opacity slider is disabled and its value ignored.

Note For the Opacity Gain and Solid Matte modes, if an object has non-zero Transparency, objects behind it makes their usual contribution to the matte channel's values. This is the difference between setting Matte Opacity to 0.0 in these modes, and choosing the Black Hole mode.

Matte Opacity

This value behaves in different ways based on which Matte Opacity Mode is selected (Opacity Gain or Solid Matte).

For example, for the Opacity Gain mode, the Matte Opacity slider value indicates the transparent multiplier amount for the alpha channel. The default is 1, which means that any opaque object registers a full alpha value.

If the Matte Opacity value is 1, a 0 alpha value is registered. Any values between 0 and 1 act as a multiplier to the alpha channel value to arrive at a new alpha value.

Shading group node

Shading group node attributes

For more information on Maya's shading group node, see "Shading group node" on page 24.

Shading Group attributes

In the Shading Group's Attribute Editor, the mental ray section contains the following options:

Flags

These are the options in the Flags section.

Opaque

Turn this on if the material is fully opaque. It should assist in speeding up mental ray rendering.

Contours

These are the options in the Contours section. Each shading group can have individual contour rendering attributes defined. Set the following options to achieve the desired look. See also "Contours" on page 317 in the *Rendering* guide.

Enable Contour Shading

Enables contour shading for all objects associated with the shading group.

Color

The color of the contour lines. This attribute can only be a color and cannot have a procedural or texture map connected to it.

Alpha

The alpha of the contour lines.

Width

The width of the contour lines.

Relative Width

If off, *Width* is specified as (fractional) number of pixels. If on, *Width* is specified in percents of the horizontal image resolution thus maintaining the relative contour size if the resolution changes.

Custom Shaders

These are the options in the Custom Shaders section.

Suppress all Maya Shaders

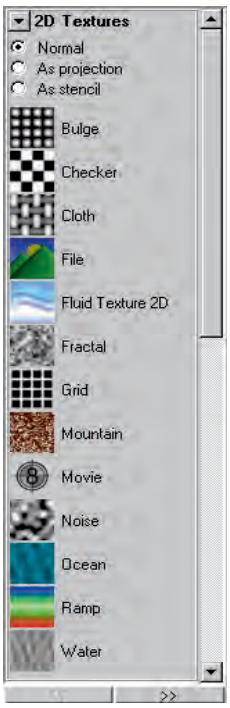
Use this for backwards compatibility as it disables automatic translation of Maya shaders. Only the mental ray ports are evaluated and exported.

Export with Shading Engine/Export with Volume Sampler

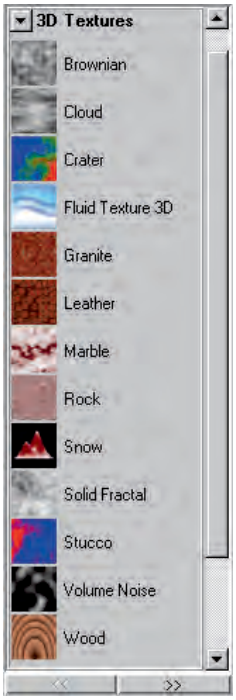
When turned on, these both insert additional helper shaders into the export stream. These shaders are required if you want to write custom shaders that cooperate with the Maya base shader package delivered with mental ray for Maya. These options are for advanced mental ray for Maya users only.

Texture nodes

Overview of texture nodes



2D Textures



3D Textures



Environment Textures and Other Textures

The Texture tab in the Create Bar and the Create Render Node window includes 2D textures, 3D textures, Env(ironment) textures, and Other textures (Layered Texture). For information about 2D textures, see About 2D textures. For information about 3D textures, see About 3D textures.

Some attributes are shared among many surface materials, are therefore grouped separately, and are described in:

- "Shared 2D texture attributes" on page 386.
- "Shared 3D texture attributes" on page 405.

For texture-specific attributes, see the 2D or 3D texture name.

2D textures

About 2D textures

2D textures available in the Create Render Node window include: Bulge, File, Grid, etc. For more information regarding a specific attribute, see:

- "Bulge" on page 368

- ”Checker” on page 368
- ”Cloth” on page 369
- ”File” on page 370
- ”Fluid Texture 2D” on page 374
- ”Fractal” on page 374
- ”Grid” on page 376
- ”Mountain” on page 376
- ”Movie” on page 377
- ”Noise” on page 378
- ”Ocean” on page 381
- ”Ramp” on page 381
- ”Water” on page 383

For attributes shared among 2D textures, see

- ”Shared 2D texture attributes” on page 386.

Bulge



Procedurally creates a grid of white squares that fade to gray toward the edges. Use as a bump or displacement map to create surface bulges, as a transparency map or specular map to simulate real-world objects, such as windows that are dirty around the edges, or as a color map to simulate tiles.

Find this texture in the Create bar. To apply this texture as a texture map, see ”Map a 2D or 3D texture” on page 74.

Uwidth, Vwidth

The width of the texture squares in U and V directions. The range is 0 to 1. The default value is 0.1.

Checker



Represents a checkerboard pattern.

Find this texture in the Create bar. To apply this texture as a texture map, see ”Map a 2D or 3D texture” on page 74.

Color1, Color2

The two colors of the checkerboard squares.

Contrast

Contrast between the two texture colors. The range is 0 (the two colors are averaged over the entire texture) to 1. The default value is 1.

Cloth



Simulates fabric or other woven materials.

Find this texture in the Create bar. To apply this texture as a texture map, see "Map a 2D or 3D texture" on page 74.

Tips

- Rendering is faster if the randomizing attributes (Randomness, Width Spread, and Bright Spread) are set to 0.
- Very fine cloth textures may produce aliasing or moiré patterns, especially when viewed from a distance. If this occurs, set the Randomness value to a small non-zero value.
- If you apply the cloth texture as a bump or displacement, set the U Color and V Color to white, the Gap Color to black, and use the Color Balance attributes (Alpha Gain and Alpha Offset) to control the intensity of the bump/displacement effect.
- Decrease the bump node's Bump Filter value to provide greater definition in the bump/displacement effect. Generally, the Alpha Gain and Bump Filter values should be very low (less than 0.1).

Gap Color

The color of the area between the warp (U direction) and weft (V direction) threads. The colors blend into the Gap Color at their edges. A lighter Gap Color simulates a cloth with softer, more translucent threads.

U Color, V Color

U and V thread colors. Double-click the color bar to open the Color Chooser and select colors.

U Width, V Width

U and V thread widths. If the thread width is 1, the threads touch with no gap between them. If the thread width is 0, the thread disappears. The range is 0 to 1. The default value is 0.75.

U Wave, V Wave

The waviness of U and V threads. Use to create special weave effects. The range is 0 to 0.5. The default value is 0.

Randomness

Smears the texture randomly in U and V directions. Adjust the Randomness value to create natural-looking cloth with irregular threads, or to prevent aliasing and moiré patterns on very fine cloth textures. The valid range is 0 to infinity. The range is 0 to 1. The default value is 0.

Width Spread

Randomizes the width of each thread along its length by subtracting a random amount (between 0 and the Width Spread value) from the U Width and V Width values. For example, if Width Spread is greater than or equal to the Width value, some threads disappear at certain points along their length. The range is 0 to 1. The default value is 0.

Bright Spread

Randomizes the brightness of each thread along its length by subtracting a random amount (between 0 and the Bright Spread value) from U Color and V Color (similar to Width Spread). The range is 0 to 1. The default value is 0.

File



Lets you use an image file as a 2D texture.

To learn more about File textures and how to create them, see ”File textures” on page 31.

Find this texture in the Create bar. To apply this texture as a texture map, see ”Map a 2D or 3D texture” on page 74.

Filter Type

The sampling technique applied to the image file during rendering. The Quadratic, Quartic, and Gaussian filters only work when the File texture is mapped directly to a shading group. The default setting is Quadratic.

If off, there is no filtering. For games design, this can be useful to view a texture’s pixels without interpolation by the renderer.

Tips

- The quadratic filter type provides the best quality to cost ratio. With the default settings, this filtering scheme provides crisper details than mipmap, at a reasonable cost.
- IFF image file format is optimal for performance.

Quadratic, Quartic, Gaussian	Types of bell curves, in which the extreme values get less weight than values toward the center of the curve.

Extreme means points in the texture near the far edge of the filter's sample region.

Center of the curve means the center of the region being filtered.

Quadratic and Quartic approximate the Gaussian filter type, but are optimized for speed. Since this method can decrease rendering speed, use mostly for high-quality rendering. Quadratic is the most efficient filter type.

Mipmap Mipmap stores values starting with values averaged at a large texture map size, and linearly decreasing map sizes down to a single pixel value.

Use this filter for previewing—it's fast and provides moderately good results. Do not use for high quality renders, however. Textures may swim or appear blurry.

Mipmap is inexpensive to use. Maya uses it as a technique to store color values by default. The performance cost associated with using the Mipmap filter type is negligible compared to using other filter types.

Box Uses a simple box sampling method for the texture map. Each sample of the map is given the same shading sample weight. The Box filter uses the sum of the values sampled divided by the number of samples taken.

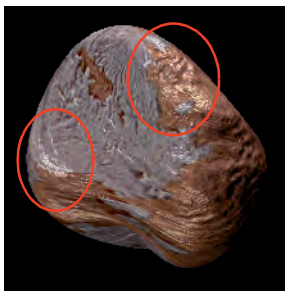
Pre-Filter

The Pre-Filter and Pre-Filter Radius attributes are used to correct file textures that are aliased or contain noise in unwanted areas. This can be very useful when displacement mapping.

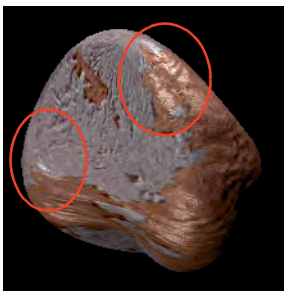
When on, the image file is pre-filtered to cancel out noise and aliasing which helps provide better quality results, particularly for bump maps. Pre-Filter is off by default. Turn it on to enable the Pre-Filter Radius attribute.

Pre-Filter Radius

Determines the size of the filtering radius. The default value of 2.0 works for most images, but you can increase the radius to provide even smoother results.



Before Pre-filter



After Pre-filter

Image Name

The name of the image file or movie file used by the File texture.

For tips on creating images for File textures, see "Considerations for creating file textures" on page 31.

To use a sequence of image files to create an animation, the file name must be expressed in one of the following three formats:

```
name.#.ext
name.ext.#
name.#
```

where *name* is the base name of the file; # is the frame number (with or without leading 0s), *ext* is the file extension of the file.

To use a sequence of image files to create an animated file texture, the file extensions must be separated from the basename and, or the extension by periods.

For example, the following works:

```
test.1.iff
test.0001.iff
test.1
test.0001
test.iff.1
test.iff.0001
```

But the following would not work:

```
test1
test0001
test1.iff
test0001.iff
```

Reload

Use this to force a refresh (read from disk to temporary memory) of the texture. This is recommended in situations where textures being used are updated by other artists.

Edit

Launches an external application from Maya so that you can edit your textures. The default system image editor is used, unless a specific application is specified in the Application preferences. For more information, see “Application preferences” in the *Basics* guide.

View

Launches an external application from Maya so that you can view your textures. The default system image viewer is used, unless a specific application is specified in the Application preferences. For more information, see “Application preferences” in the *Basics* guide.

Use BOT

Use block ordered textures.

If the image file is not a BOT file, Maya creates a temporary BOT file for the image file during rendering. This can make rendering slower and can increase the amount of disk space used during rendering. However, it uses less memory during the rendering process. Because of this, converting all image file textures to BOT files *before* rendering using the Optimize Scene command can be helpful.

Disable File Load

If set, then the texture is not loaded. Instead a grey color is output in place of the image.

Use Image Sequence
Image Number
Frame Offset

To use a sequence of image files as an animated texture when rendering, turn on Use Image Sequence. Use Image Sequence is off by default.

When using an image sequence, you can keyframe the Image Number value (it’s automatically keyed to 1 by default). In addition, you can offset the Image Number keyframe by entering a frame number in Frame Offset.

Interactive Sequence Caching Options

Use Interactive Sequence Caching

Interactive Sequence Caching is used for caching file textures when animating textures to play the animation at regular speed.

When Use Interactive Sequence Caching is on, the file textures you specify within the range of the Sequence Start, Sequence End, and Sequence Increment are loaded into memory only once. This provides faster interactive animation of the file textures.

Turn Use Interactive Sequence Caching on to get better performance when:

- using a sequence of frames for the file textures
- using Hardware texturing in the 3d view
- you need to *scrub* along the time line (move the time slider back and forth) and see the animated texture update.

Use the following attributes to indicate which frames you want to load. If you don't load them all, Maya uses the closest available frame at playback.

Note These attributes do not alter the final rendered image.

Sequence Start

The number of the first frame Maya loads into memory when Use Interactive Sequence Caching is on.

Sequence End

The number of the last frame Maya loads into memory when Use Interactive Sequence Caching is on.

Sequence Increment

Controls how many frames are skipped (if any) Maya loads into memory when Use Interactive Sequence Caching is on. If 1, Maya loads every frame between Sequence Start and Sequence End. If 2, Maya loads every second frame, and so on.

Fluid Texture 2D



Find this texture in the Create bar. To use this texture, see "Apply a fluid texture to an object" on page 94 in the *Fluid Effects* guide.

Fractal



Represents a random function with a particular frequency distribution (a fractal). You can use the Fractal texture as a bump or displacement map to simulate rock or mountains, or as a transparency map to simulate clouds or flames. The Fractal texture has the same level of detail at any level of magnification (that is, at different distances from the camera).

Find this texture in the Create bar. To apply this texture as a texture map, see "Map a 2D or 3D texture" on page 74.

Amplitude

A scaling factor applied to all values in the texture. The valid range is 0 to infinity. The range is 0 to 1. The default value is 1.

Threshold

An offset factor applied to all values in the texture. The valid range is 0 to infinity. The range is 0 to 1. The default value is 0.

Ratio

Controls the frequency of the fractal pattern. The range is 0 (low frequency) to 1 (high frequency). The default value is 0.707.

Frequency Ratio

Determines the relative spacial scale of the noise frequencies. If this ratio is not a whole integer then the fractal does not repeat at the integer uv boundaries. A cylinder with default placement would then display a seam.

Level Min, Level Max

The minimum and maximum number of iterations used to calculate the fractal pattern. These values control the granularity of the fractal pattern. The valid range is 0 to 100. The range is 0 to 25. The default value is 0 for Level Min and 9 for Level Max.

Inflection

This applies a kink in the noise function. This is useful for creating puffy or bumpy effects.

Animated

Animate the fractal pattern by setting Animated on and keyframing the Time value. The Fractal texture takes longer to calculate when Animated is on. Animated is off by default.

Time

Change the Time value to adjust an animated fractal pattern. If Animated is off, the Time attribute is unavailable. The range is 0 to 100. The default is 0.

Time Ratio

Determines the relative time scale of the noise frequencies. If this ratio is not a whole integer then the animation does not repeat when time = 1. The default is equal to the frequency ratio, which means that higher frequency

noises move faster in direct proportion to the frequency. Many natural effects, such as water waves, move instead relative to the square root of the frequency, therefore it may create better motion to make the timeRatio = sqrt(frequencyRatio). For example, if the frequencyRatio is 2, make the timeRatio = 1.4.

Grid



Represents a scalar grid pattern.

Find this texture in the Create bar. To apply this texture as a texture map, see "Map a 2D or 3D texture" on page 74.

Line Color

Color of the grid lines. The default color is white.

Filler Color

Color of the spaces between the grid lines. The default color is black.

U Width, V Width

Width of the grid lines in U and V directions. The valid range is 0 to 1. The range is 0 to 0.5. The default value is 0.1.

Contrast

Contrast between the Line Color and the Filler Color. The range is 0 (the two colors are averaged over the entire texture) to 1. The default value is 1.

Mountain



Find this texture in the Create bar.

Simulates rocky terrain using a 2D fractal pattern. To apply this texture as a texture map, see "Map a 2D or 3D texture" on page 74.

Use the Mountain texture as both a color map and a bump or displacement map (on a flat surface) to simulate snow-capped mountains. To do so, apply the Mountain texture this way:

- The texture calculates the color map based on the bump/displacement map, so, for example, the location of snow is based on the surface's displacement.
- The color attributes (Snow Color and Rock Color) relate only to the color map and have no effect on the bump/displacement map—and all non-color attributes relate only to the bump/displacement map and have no effect on the color map.

- The Boundary, Snow Altitude, Snow Dropoff, Snow Slope, and Depth Max attribute values of the bump/displacement map override those of the color map. For example, the Boundary value of the bump/displacement map controls the raggedness of the snow/rock boundary of the color map.

Snow Color, Rock Color

Color of the snow and rock. Click the color file to choose a different color from the Color Chooser.

Amplitude

Scaling factor applied to all values in the texture. The valid range is 0 to infinity. The range is 0 to 1. The default is 1.

Snow Roughness

Roughness of the snow. The range is 0 (very smooth snow) to 1 (very rough snow). The default is 0.4.

Rock Roughness

Roughness of the rock. The range is 0 (very smooth rock) to 1 (very rough rock). The default is 0.707.

Boundary

Raggedness of the rock/snow boundary. The range is 0 (very smooth rock/snow boundary) to 1 (very rough rock/snow boundary). The default is 1.

Snow Altitude

The level (altitude) of the transition between rock and snow. The valid range is 0 to infinity. The range is 0 to 1. The default is 0.5.

Snow Dropoff

The suddenness with which snow no longer sticks to the mountain. The valid range is 0 to infinity. The default is 2.

Snow Slope

The maximum angle (expressed as a decimal value) over which snow does not stick to the mountain. For example, where the slope exceeds the Snow Slope value, it would be bare rock. The valid range is 0 to infinity. The range is 0 to 3. The default is 0.8.

Depth Max

The maximum number of iterations used to calculate the fractal pattern, which controls the granularity of the fractal pattern. The range is 0 to 40. The default is 20.

Movie



The movie texture assumes the following:

- an entire multiple frame sequence is stored in a single multiple frame file (a movie file) instead of a sequence of individual image files.
- is optimized for reading and displaying those frames interactively as quickly as possible.

The Movie texture shares the same attributes as the File texture. The difference is that the Movie texture assumes all frames are stored in a single concatenated file using the assigned Image Name instead of separate files.

Find this texture in the Create bar. To apply this texture as a texture map, see "Map a 2D or 3D texture" on page 74.

Note	The first time you access a frame from an MPEG file, it may be slow to load. The movie library has to scan to the end of an MPEG file to see how many frames are in it since this information is not available in the movie header.

Noise



Can be used to create many different types of effects.

Find this texture in the Create bar. To apply this texture as a texture map, see "Map a 2D or 3D texture" on page 74.

Threshold

The number added to the whole fractal effect, making it uniformly brighter. If some parts of the fractal are pushed up out of range (greater than 1.0), they are clipped to 1.0. If the Volume Noise is used as a bump map, it appears as plateau regions.

Amplitude

Scaling factor applied to all the values in the texture, centered around the texture's average value.

- When you increase Amplitude, the light areas get lighter and the dark areas get darker.
- If Noise is used as a bump map, increasing Amplitude results in higher bumps and deeper valleys.
- If set to a value greater than 1.0, the parts of the texture that scale out of range are clipped. On a bump map, they display as plateau regions.

Ratio

Controls the fractal noise frequency. Increase this value to increase the fineness of the fractal detail.

Frequency Ratio

Determines the relative spacial scale of the noise frequencies. If not a whole number, the fractal does not repeat at the UV boundaries. For instance, a cylinder with default placement displays a seam.

Depth Max

Controls how much calculation is done by the Noise texture. Since the Fractal texture process produces a more detailed fractal, it takes longer to perform. By default, the texture chooses an appropriate level for the volume being rendered. Use Depth Max to control the maximum amount of calculation for the texture.

Inflection

Applies a kink in the noise function. Useful for creating puffy or bumpy effects.

Time

Used to animate the Noise texture. You can keyframe the Time attribute to control the rate and amount of change of the texture.

Frequency

Determines the fundamental frequency for the noise. As this value increases the noise becomes more detailed. It has the inverse effect of the scale parameter.

Implode

This warps the noise function in a concentric fashion about a point defined by the Implode Center. At a value of zero there is no effect, while at a value of 1.0 it is a spherical projection of the noise function, creating a starburst effect. Negative values can be used to skew the noise outward instead of inward.

Implode Center

This defines the center UV point about which the implode effect is defined.

Noise Type

Determines which noise to use during the fractal iteration.

Perlin Noise	The standard 3D noise used in the solidFractal texture. Billow has a puffy, cloud-like effect.
Wave	A sum of 3D waves in space.
Wispy	A Perlin noise that is uses a second noise as a smear map; this makes the noise stretch out in places, looking wispy. When the time value is animated the smear texture is moved causing an undulating effect. It creates an effect similar to thin clouds being blown by wind.

SpaceTime A 4-dimensional version of the Perlin noise, where time is the 4th dimension.

Density

Controls how many cells are imbedded in the medium used by the Billow noise type.

At 1.0, the medium is completely packed with cells. Reduce this value to make the cells sparser. If the texture is used as a bump map, low values for Density results in smooth looking surfaces with occasional bumps.

Spottyness

Controls the density randomization of individual cells used by the Billow noise type.

When set close to 0, all the cells are the same density. As you increase Spottyness, some cells are randomly denser or thinner than others.

Size Rand

Controls the randomization of the size of the individual blobs used by the Billow noise type. When it is close to 0, all the cells are the same size. As you increase Size Rand, some cells are smaller than others, in a random fashion.

Randomness

Controls how the cells for the Billow noise type are arranged relative to one another. Set to 1.0 for a more natural random distribution of cells.

If set to 0, all the spots are laid out in a regular pattern. This can provide interesting effects when used as a bump map—for instance, you can make things like insect eyes, or machine-tooled raspy surfaces.

Falloff

Controls the way intensity falls off for individual blobs for the Billow noise type.

Linear A uniform falloff from the center to a value of zero at the edges of the blobs.

Smooth More natural looking, using a gaussian falloff. Fast focuses the intensity more towards the center of the blobs.

Bubble Uses a reverse falloff, fading to zero at the blob center.

Num Waves

Determines how many waves to generate for the Wave noise type. The larger the number, the more random-looking and slower the texture.

Ocean

Find this texture in the Create bar. For information about Ocean, see ”Ocean shader and texture” on page 93 in the *Fluid Effects* guide.

Ramp



Creates a gradation through a series of colors. The default Ramp texture is blue/green/red. Use this texture:

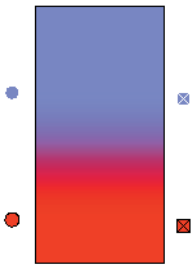
- to create different types of effects, such as stripes, geometric patterns, or mottled surfaces
- as a 2D background
- as the source file for an environmental sphere texture to simulate a sky and horizon
- as the source file for a projection texture to simulate wood grain, marble, or rock

Find this texture in the Create bar. To apply this texture as a texture map, see ”Map a 2D or 3D texture” on page 74.

Note	Very complex ramp textures may experience aliasing during an animation. If this occurs, convert the ramp texture into an image file (see ”Convert a texture or shading network to a File Texture” on page 81 for details).

Type

The direction of the color ramp. The default is V Ramp. The following shows what happens when you select the Circular Type and adjust the colors of the Ramp swatch in the Attribute Editor (see also “Ramp” next).



Ramp in Attribute Editor



Object in view



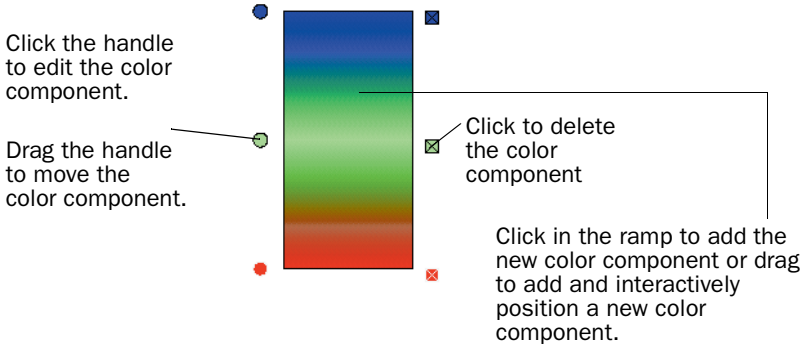
Swatch in Hypershade

Interpolation

Controls the way colors blend in the ramp. The default setting is Linear. In the above example, because the surface is spherical, a Smooth Interpolation type works well.

Ramp

Each color component in the ramp has a circular color handle on the left side, and a square color icon on the right side. The active color has a white border around its color handle and icon.



Note Only changes in Type, Interpolation, Selected Position, and Selected Color are displayed in the ramp. Changes in all attributes are displayed in the Hypershade swatch.

Advanced ramp features exist. For more information, see "Mapping the color of a ramp index to a texture" on page 327 and "Mapping the position of a ramp index to a texture" on page 328.

Selected Color

The active color component. This attribute applies to the active color only.

Selected Position

Position of the active color component in the ramp. This attribute applies to the active color only. The range is 0 (bottom of ramp) to 1 (top of ramp).

U Wave, V Wave

Controls the amplitude of a sine wave offset of the texture in the U and V directions. Increasing the U Wave or V Wave increases the display of the texture's waviness. The range is 0 (no wave) to 1. The default is 0.

Tip	To increase the number of waves in the texture, increase the Repeat UV values in the 2D texture placement node.

Noise

Offset amount in the U and V directions by 2D noise. If the texture repeats (Repeat UV values are greater than 1), the noise does not repeat (each instance of the texture is unique). The range is 0 (no noise) to 1. The default is 0.

Noise Freq

Controls the noise granularity (if the Noise value, above, is non-zero). The range is 0 to 1. The default is 0.5.

HSV Color Noise

Randomize a Ramp texture's color using three separate 2D noises which affect the color's Hue, Saturation, and Value.

Hue Noise

Offsets the color hue. Use to mark the color with specks of different colors. The range is 0 to 1. The default is 0.

Sat Noise

Offsets the color saturation (or whiteness). Use to create a weathered look. The range is 0 to 1. The default is 0.

Val Noise

Offsets the color value (or blackness). The range is 0 to 1. The default is 0.

Hue Noise Freq, Sat Noise Freq, Val Noise Freq

Controls the granularity for hue, saturation, and value noise. The range is 0 to 1. The default is 0.5. (For each non-zero Freq value, additional calculations may slow down rendering.)

Water



Simulates linear water waves, concentric water ripples (like an object falling into water), or a combination of waves and ripples. Use as a bump or displacement map to simulate water, or as a color map to simulate light reflections or refractions from a water surface.

Find this texture in the Create bar. To apply this texture as a texture map, see "Map a 2D or 3D texture" on page 74.

Number Of Waves

The number of linear waves in the texture. The valid range is 0 to 100. The slider range is 0 to 32. The default is 8.

Tips

- For water ripples with no linear waves, set Number Of Waves to 0.
- To combine linear waves with concentric ripples, set Number Of Waves to a low number (1 to 3).

Wave Time

Controls the appearance of the waves over time. The range is 0 to 1. The default is 0.

The wave effect is similar to the waves produced from a boat—the waves start at a point with a certain velocity and amplitude. This is time zero. As time increases, the waves travel to shore and the appearance changes (velocity and amplitude decrease). To simulate moving waves, animate the Wave Time value. The waves move as this value increases. Maya determines the wave speed by the Wave Velocity value and the rate at which you animate the Wave Time value.

Wave Velocity

The wave speed. The valid range is 0 to infinity. The range is 0 to 1. The default is 1.

Wave Amplitude

Scales the wave height. The valid range is 0 to infinity. The range is 0 to 1. The default is 0.05.

Fast

An optimization for the Water texture. When on, Maya computes the color tables once per frame. When off, Maya computes the color tables for every sample.

Tip The only time you might turn this off is when water is viewed close-up in the final scene.

Wave Frequency

Controls the distance between primary waves. The higher the value, the shorter the distance. The valid range is 0 to infinity. The slider range is 0 to 20. The default is 4.

Sub Wave Frequency

Controls the distance between secondary waves that ride on top of primary waves (for example, white caps). The valid range is 0 to infinity. The slider range is 0 to 1. The default is 0.125.

Smoothness

Controls the intensity of secondary waves. The valid range is 0 to infinity. The slider range is 0 to 5. The default is 2.

Wind UV

The strength of wind in the U and V directions (which determines the overall direction of the linear wave pattern). The range is from -1 to 1. The default for U is 1. The default for V is 0.

Concentric Ripple Attributes

Control the appearance of concentric water ripples. The Concentric Ripple attributes do not affect the linear wave component of the texture.

Ripple Time

Controls the appearance of ripples over time. The range is 0 to 1. The default is 0.

For example, imagine a water droplet falling into a glass of still water—at time 0 there is no ripple since the droplet has not touched the surface of the water. As the time attribute increases to a value greater than 0, the droplet has fallen onto the water surface and the ripple wave effect simulates the effect on the water in the glass at that point in time. When time has reached a value of 1, the effect of the droplet on the water surface is nearly complete and the water in the glass becomes still again.

To simulate moving water ripples, animate the Ripple Time value. The ripples move as this value increases. The actual speed of the ripples is determined by the Group Velocity value and the rate at which you animate the Ripple Time value.

Ripple Frequency

Controls the distance between individual ripples. The higher the value, the shorter the distance. The valid range is 0 to infinity. The slider range is 0 to 20. The default is 25.

Ripple Amplitude

Scales the height of the ripples. The valid range is 0 to infinity. The slider range is 0 to 1. The default is 0.05.

Drop Size

The mass of the droplet that starts the water ripples. A Drop Size value of 0 produces no ripple effect because the droplet has no mass. As the Drop Size value increases, the mass of the drop increases, causing a greater ripple effect. The valid range is 0 to infinity. The slider range is 0 to 1. The default is 0.3.

Ripple Origin

The location of the center of the ripples along U and V directions. The range is from 0 to 1. The default is 0.5.

Group Velocity

The speed of the primary ripple. The valid range is 0 to infinity. The slider range is 0 to 10. The default is 1.

Phase Velocity

The speed of sub-ripples. The valid range is 0 to infinity. The slider range is 0 to 10. The default is 2.5.

Spread Start

Degree of effect a droplet has on a still water surface at time 0. A concentric ripple starts as a point of disturbance in space (defined by the Ripple Origin values) when the Ripple Time value is 0. The size of the disturbance at time 0 is determined by the Spread Start value. The greater the value, the greater the effect of the disturbance at time 0. The valid range is 0 to infinity. The slider range is 0 to 1. The default is 0.005.

Spread Rate

Rate at which the primary ripple breaks into sub-ripples. (As a ripple expands outward, it breaks up into sub-ripples.) The valid range is 0 to infinity. The slider range is 0 to 1. The default is 0.3.

Reflection Box

Activates an imaginary reflective bounding box ripples can reflect off. Reflection Box is off by default. (This effect can slow down the render speed.)

Box Min, Box Max

Defines the bounding box in the U and V directions. If Reflection Box. is off, these attributes have no effect. The range is 0 to 1. The default for Box Min is 0; the default for Box Max is 1.

Shared 2D texture attributes

For texture-specific attributes, see the 2D texture name: Bulge, Checker, Cloth, File, Fluid Texture 2D, Fractal, Grid, Mountain, Movie, Noise, Ocean, Ramp, Water.

Color Balance

Corrects the color or intensity of a texture.

Default Color

If you map a texture to a material in such a way that it that does not cover the entire surface, the file node's Default Color shows through. To select a different color, click the color bar to open the Color Chooser. To change the texture's coverage, use the placement options.

Color Gain

Scaling factor applied to the texture's outColor channel. For example, you can color-correct a texture that appears too green by setting the Color Gain to a shade of blue. The default color is white (no effect).

Color Offset

Offset factor applied to the texture's outColor channel. For example, you can brighten a texture that appears too dark by setting the Color Offset to a shade of gray. The default color is black (no effect).

Alpha Gain

Only has an effect if the texture is used as a bump or displacement. Scaling factor applied to the texture's outAlpha channel. The default value is 1 (no effect).

Alpha Offset

Only has an effect if the texture is used as a bump or displacement. Offset factor applied to the texture's outAlpha channel. For example, if the Alpha Gain value is -1 and the Alpha Offset value is 1, the outAlpha channel is inverted. The default value is 0 (no effect).

Alpha is Luminance

Off by default. The alpha (mask) output depends on the luminance of the color channels. Bright areas of the texture are more opaque when compositing, and dark areas are more transparent.

Note	You cannot use Alpha as Luminance for Cloth, Ramp, or Stencil textures.

Effects

Filter

Filter attributes scale the size of the filter and let you specify the amount of blur in the texture map. Use it as an anti-aliasing technique used to refine file textures, reduce flickering, or to achieve special effects.

By default, Filter is set to a value of 1.0 to help prevent such aliasing effects. The effect of Filter is related directly to eye space. As the object moves further away from the eye, the more the texture blurs.

For more information, see "Texture filtering" on page 34.

Filter Offset

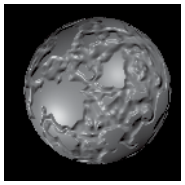
Controls the texture blur in texture space (not eye space). Use Filter Offset for a blurred effect instead of anti-aliasing. Maya adds a constant value to the Filter setting. The default value is 0. Increasing the value increases the texture blur. For example, 1.00 completely blurs the texture.

Tip	A Filter and Filter Offset of 0.00 results in no blur effect, however a small amount of blur can help reduce moiré and aliasing effects in texture maps.

Invert

Reverses all texture colors (black becomes white, white becomes black, and so on). Invert is off by default. For example, you can change a bump or displacement map's raised regions to depressions and vice versa by setting Invert on or off.

Stucco texture bump mapped

Invert off  Invert on

Color Remap

Applies a color map to the texture and lets you add or subtract colors from a texture's default settings. Maya maps the U value to the original texture's hue, and the V value to the original texture's intensity. (Color Remap is similar to the "Shading Map" on page 336 material and uses the Rgb to Hsv Color Utility.)

To remap a texture

Click the Color Remap button. The texture colors change and a Remap Ramp Attribute Editor appears. Adjust the Ramp texture colors and attributes if necessary.

UV Coord

The current UV coordinate values of the current sample point.

3D textures

About 3D textures

3D textures allow objects to appear as if carved out of materials such as marble, rock, or wood. 3D textures available in the Create Render Node window include the following:

- "Brownian" on page 389
- "Cloud" on page 390
- "Crater" on page 391
- "Fluid Texture 3D" on page 392
- "Granite" on page 392
- "Leather" on page 393
- "Marble" on page 395
- "Rock" on page 396
- "Snow" on page 397
- "Solid Fractal" on page 398
- "Stucco" on page 399
- "Volume Noise" on page 400
- "Wood" on page 403

For attributes shared among 3D textures, see

- "Shared 3D texture attributes" on page 405.

Brownian

Resembles thickly painted metal.

Find this texture in the Create bar. To apply this texture as a texture map, see "Map a 2D or 3D texture" on page 74.

Lacunarity

Defines the gap between the frequencies (Octaves) you add to form the texture. By default, Lacunarity for noise-based textures is set to 2.0, but you can adjust the value to create interesting effects.

Increment

Determines the ratio for the fractal noise. Results in a crisper texture when close to zero, and a smoother texture when close to 1.

Octaves

Sets the upper limit for noise frequencies (the repeat value of the fractal). See also “Depth”.

Weight3d

Determines how wavy the image appears when projected by controlling the scale of the frequency of any fractal used in the procedure.

Cloud

Simulates clouds.

You should only map the Cloud texture to a sphere. You can combine several spheres to create complex cloud arrangements. If you map the Cloud texture to any other type of surface, the results may be unpredictable.

The area surrounding the cloud is always transparent, regardless of the map type.

Find this texture in the Create bar. To apply this texture as a texture map, see "Map a 2D or 3D texture" on page 74.

Color1, Color2

The two colors blended together to form the cloud. To select different colors, click the color bars to open the Color Chooser.

Contrast

The contrast between Color1 and Color2. For example, if the Contrast value is -1, Color1 and Color2 are reversed. The range is from - infinity (the two colors are averaged over the entire texture) to + infinity. The default is 0.5.

Amplitude

Controls the strength of the fractal noise used to generate the Cloud texture. The valid range is 0 (no noise) to + infinity (strong noise). The default is 1.

Depth

Controls the granularity of the texture. Values represent the minimum and maximum number of iterations used to calculate the texture pattern. The range is 0 to + infinity. The defaults are 0 and 8.

Ripples

Determines the texture's waviness in the X, Y, and Z directions. The values represent the frequency scale of the fractal used to generate the texture. The range is from 0 to + infinity on X, Y and Z. The default is 1.

Soft Edges

Simulates natural looking clouds. Gradually increases the transparency of the texture as the surface it is mapped to turns away from the camera. If Soft Edges is off, the texture is entirely opaque, and looks similar to the Fractal texture. Soft Edges is on by default.

Edge Thresh, Center Thresh

If Center Thresh is low and Edge Thresh is high, the texture resembles a dense cotton-ball. If Center Thresh is high and Edge Thresh is low, the texture resembles a wispy cloud. The range is from - infinity to + infinity. The default is 0 for Center Thresh and 1 for Edge Thresh.

Transp Range

The range over which the texture becomes transparent. The value controls the sharpness/softness of the cloud's edges. The valid range is 0 to infinity. The slider range is 0 (sharp edges) to 1 (very soft edges). The default is 0.5.

Ratio

Controls the frequency of the fractal noise used to generate the Cloud texture. The range is 0 (low frequency) to + infinity (high frequency). The default is 0.707.

Crater

Creates the appearance of both plateaus and craters by mixing normal disturbance and 3D disturbance, such as color or transparency. The Crater texture provides a three component attribute (Out Color RGB) and a Normal output (Out Normal X, Y, and Z).

Find this texture in the Create bar. To apply this texture as a texture map, see "Map a 2D or 3D texture" on page 74.

Shaker

Increase this value to add more detail to the default Shaker texture (as though it has been shaken up). If used as a bump map, increase the value to increase the number of craters and valleys.

Channel1, Channel2, Channel3

The three channels through which information such as color values passes. You can also supply information to the channels using a three-channel (RGB) mapping.

Melt

Controls the edge softness between the colors in the texture. Increase this value to display the borders between the colors smoother and wider.

Balance

Controls the ratio of the three shaken (or disturbed) colors.

Frequency

Controls the frequency of how many times the texture colors are shaken.

Normal Options (Crater)

Note	Norm Depth, Norm Melt, Norm Balance, and Norm Frequency only has an effect if the Out Normal attribute is connected to the Normal Camera attribute of a shader.

Norm Depth

Controls the depth of the craters when the texture is used as a bump map. Increasing Norm Depth deepens the craters.

Norm Melt

Controls the softness of the crater edges when this texture is used as a bump map. Increase Norm Melt to make the edges softer. Animate this texture to make the cratered surface look like it is melting.

Norm Balance

Controls the ratio between the low and high normal's disturbance when this texture is used as a bump map.

Norm Frequency

Norm Frequency controls the amount of rough detail when this texture is used as a bump map. Increase Norm Frequency to make the texture rougher, with finer detail. Decrease it to make the roughness larger-grained.

Fluid Texture 3D

Find this texture in the Create bar. For information on Fluid Texture 3D, see "Apply a fluid texture to an object" on page 94 in the *Fluid Effects* guide.

Granite

Simulates granite.

Find this texture in the Create bar. To apply this texture as a texture map, see "Map a 2D or 3D texture" on page 74.

Tips	• The Granite texture is the same as the Leather texture except that there are three cell colors instead of one. • The Granite texture can take a long time to render. To save time when rendering, convert the granite texture into an image file (see "Baking illumination and color" on page 147).

Color1, Color2, Color3, Filler Color

The color of the three different types of cells (Color1, Color2, Color3) and the color surrounding the cells (Filler Color). Click any of these color bars to select a different color from the Color Chooser.

Cell Size

Represents the individual cell size. This value scales the entire texture. The valid range is 0 to infinity. The slider range is 0 to 1. The default is 0.15.

Density

Controls the cell spacing. The valid range is 0 to infinity. The slider range is 0 to 1 (fully packed). The default is 1.

Mix Ratio

Determines which color is dominant. The range is 0 (Color1 is dominant) to 1 (Color3 is dominant). The default is 0.5 (Color2 is dominant).

Spottyness

Randomizes the cell color intensity. The range is 0 to infinity. The slider range is 0 to 1. At 0 all cells have the same intensity. At 1 the cell intensity is entirely random. The default is 0.3. The Threshold value also influences the cell color intensity.

Randomness

Randomizes the cell position. The valid range is 0 to infinity. The slider range is 0 to 1. At 0 cells are arranged in a regular 3D lattice. At 1, cell location is entirely random. The default value is 1.

Threshold

Controls how cell colors and filler color mix into each other. The valid range is 0 to infinity. The slider range is 0 to 1 (if no mixing occurs, cells display as solid color dots). The default value is 0.5.

Creases

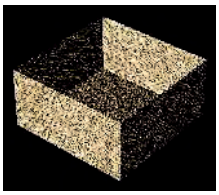
Creates boundaries between cells. If off, the cells diffuse uniformly into each other. Creases is on by default.

Leather

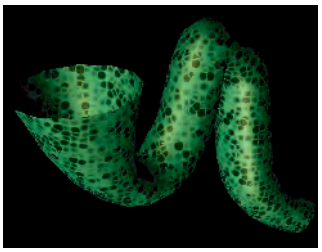
Simulates leather. Can also be used to simulate materials such as snake or alligator skin, styrofoam, or concrete.

Find this texture in the Create bar. To apply this texture as a texture map, see ”Map a 2D or 3D texture” on page 74.

To create concrete, apply a bump map to the material and adjust the color and cell size as well as the bump map's Bump Depth attribute.



To create an alligator skin-type texture, turn Creases off and adjust the cell size and color.



Tips

- For many situations, a real leather image file (File texture) produces a good leather simulation; however, it is often difficult to map a file texture to a surface without distortions and discontinuity. Chord Length or Worldspace texture mapping may eliminate distortions, but require some effort and do not always work. In these cases, use the Leather texture.
- The Leather texture uses a 3D array of spheres to simulate 2D leather. This is unlike real leather because real leather is a surface, not a solid. However, the Leather texture usually produces very realistic results. The exception is if the surface is deformed during an animation because the surface may seem to move through the solid texture. In this case, convert the texture into an image file (see "Baking illumination and color" on page 147).

Cell Color, Crease Color

The color of individual cells (Cell Color) and the color surrounding the cells (Crease Color).

Cell Size

The size of individual cells. The Cell Size value scales the entire texture. The valid range is 0 to infinity. The slider range is 0 to 1. The default is 0.5.

Density

Controls the spacing of cells in the texture. The valid range is 0 to infinity. The slider range is 0 to 1 (fully packed). The default is 1.

Spottyness

Randomizes the cell color intensity. The range is 0 to infinity. The slider range is 0 to 1. At 0 all cells have the same intensity. At 1 the cell intensity is entirely random. The default is 0.1. The Threshold value also influences the cell color intensity.

Randomness

Randomizes the cell position. The valid range is 0 to infinity. The slider range is 0 to 1. At 0 cells are arranged in a regular 3D lattice. At 1, cell location is entirely random. The default value is 0.5.

Threshold

Controls how the cell color and crease color mix into each other. The valid range is 0 to infinity. The slider range is 0 to 1 (if no mixing occurs, cells display as solid color dots). The default value is 0.83.

Creases

Creates boundaries between cells resembling creases in leather. If off, the cells diffuse uniformly into each other. Creases is on by default.

Marble

Simulates marble. Maya uses a *vein* material sandwiched between layers of *filler* material.

Find this texture in the Create bar. To apply this texture as a texture map, see ”Map a 2D or 3D texture” on page 74.

Filler Color, Vein Color

The color of the filler material and the vein material. Click a color bar to select a different color from the Color Chooser.

Vein Width

The thickness or width of the veins. The range is 0 to 1. The default is 0.1.

Diffusion

Controls the amount of Vein Color that blends into the Filler Color. The range is 0 (no blending) to 1 (smooth blending). The default is 0.5. (The Contrast value also affects how the two colors blend.)

Contrast

The contrast between the Vein Color and Filler Color. The range is 0 to 1. The default is 0.5.

Noise Attributes (Marble)

The Marble texture creates a 3D texture by projecting a 2D texture. The Noise Attributes control the randomization (using fractal noise) of the texture in the direction the texture is projected.

Amplitude

A scaling factor applied to all values in the fractal noise about the average value. The valid range is 0 to infinity. The slider range is 0 (no noise) to 1 (strong noise). The default is 1.5.

Ratio

Controls the fractal noise frequency. The valid range is 0 (low frequency) to 1 (high frequency). The default is 0.707.

Ripples

Determines the texture's waviness in the X, Y, and Z directions. The values represent the frequency scale of the fractal used to generate the texture. The range is from 0 to + infinity for X, Y, and Z. The default is 1.

Depth

The minimum and maximum number of iterations used to calculate the texture pattern. Controls the texture's granularity. The range is from 0 to 20. The default values are 0 and 20.

Rock

Simulates rock using a random 3D distribution of two different grain material types.

Find this texture in the Create bar. To apply this texture as a texture map, see "Map a 2D or 3D texture" on page 74.

Tip	Assign this texture to the material's bump map to achieve a coarser simulated texture.

Color1, Color2

The color of the two grains in the texture. To select different colors, click the color bars to open the Color Chooser.

Grain Size

Specifies the grain size and scales the entire texture. The valid range is 0 to infinity. The slider range is 0 (no grains) to 0.1 (large grains). The default value is 0.01.

Diffusion

Controls the amount Color1 blends into Color2. The range is 0 to infinity. The slider range is 0 (no blending) to 1 (smooth blending). The default is 1.

Mix Ratio

Determines the dominant color. The valid range is 0 to infinity. The slider range is 0 (Color1 is totally dominant) to 1 (Color2 is totally dominant). The default is 0.5.

Snow

Simulates snow on a surface.

Note	If you assign Snow to geometry whose surface normals and tangents are constant (for example, those of a primitive cone), the Snow texture appears as a uniform color, and the difference between the Snow Color and Surface Color is non-existent.

You can find this texture in the Create bar. To apply this texture as a texture map, see "Map a 2D or 3D texture" on page 74.

Tips	• To display snow on all objects in the scene, apply the Snow texture as a transparency map on a white material and then layer this material onto other shaders. • Try combining a Fractal bump map with a Snow color map. The snow only appears on the peaks and valleys of the bump mapped surface. For best results, set the Fractal bump map's Alpha Gain and Filter values to a low number. • To simulate windswept snow, rotate the Snow texture by rotating the 3D Placement Object about a horizontal line.

Snow Color

The color of the snow on the top of the surface.

Surface Color

The color of the surface on which the snow lies.

Threshold

Determines the maximum slope that holds snow. The range is 0 (90 degrees from horizontal) to 1 (0 degrees from horizontal). The default is 0.5 (45 degrees from horizontal).

Depth Decay

The rate at which the snow color blends into the surface color. The range is 0 to 10. The default is 5.

Thickness

The apparent depth of the snow. Thickness controls the opacity of the snow (deeper snow is more opaque). The range is 0 (transparent) to 1 (opaque). The default is 1.

Solid Fractal

Represents a 3D random function with a particular frequency distribution (fractal).

Find this texture in the Create bar. To apply this texture as a texture map, see "Map a 2D or 3D texture" on page 74.

Tip	Assign this texture to the material's bump map to achieve a coarser simulated texture.

Threshold

Offset factor applied to all values in the texture. The valid range is 0 to infinity. The slider range is 0 to 1. The default is 0.

Amplitude

Scaling factor applied to all values in the texture. The valid range is 0 to infinity. The slider range is 0 (no noise) to 1 (strong noise). The default is 1.

Ratio

Controls the frequency of the fractal noise. The range is 0 (low frequency) to 1 (high frequency). The default is 0.707.

Frequency Ratio

Determines the relative spacial scale of noise frequencies. If not a whole number, the fractal does not repeat at the UV boundaries. For instance, a cylinder with default placement would display a seam.

Ripples

Determines the texture's waviness in the X, Y, and Z directions. The values represent the frequency scale of the fractal used to generate the texture. The range is 0 to infinity. The default is 1.

Depth

The minimum and maximum number of iterations used to calculate the texture pattern. This parameter controls how fine grained the texture is. The range is 0 to 20.

Note	The following attributes let you swirl the noise pattern in a Solid Fractal texture to create interesting effects.

Bias

Attracts the -1 to 1 noise towards either 1 or 0. Values greater than zero result in a more contrasting fractal while values less than zero make it more flat and spiky.

Inflection Applies a kink in the noise function. This can be useful when creating puffy or bumpy effects. Inflection is off by default.

Animated Turn on to access the Time and Time Ratio attributes (see next).

Time

Determines the relative time scale of noise frequencies. If not a whole number, the animation does not repeat when Time = 1.

Time Ratio

Default is equal to the Frequency Ratio setting, which means higher frequency noises move faster in direct proportion to the frequency. For example, to create more natural-looking effects, such as water waves, if the Frequency Ratio is 2, set the Time Ratio to 1.4.

Stucco

Randomly disturbs the material by mixing two input attributes, Channel1 and Channel2, to create an effect resembling stains or clouds. Stucco includes Normal Options attributes you can use to control the effect. See also ”Crater” on page 391.

Find this texture in the Create bar. To apply this texture as a texture map, see ”Map a 2D or 3D texture” on page 74.

Shaker

Increase this value to add more detail to the default Shaker attribute setting (as though it has been shaken up). If used as a bump map, increase the value to increase the number of craters and valleys.

Channel1, Channel2

The two channels through which information such as color values passes. You can also supply information to the channels using a three-channel (RGB) mapping.

Normal Options (Stucco)

Note	Normal Depth and Normal Melt only have an effect if the Out Normal attribute is connected to the Normal Camera attribute of a shader.

Normal Depth

Controls the depth of the craters when the texture is used as a bump map. Increasing Normal Depth deepens the craters.

Normal Melt

Controls the softness of the crater edges when this texture is used as a bump map. Increasing Normal Melt softens the edges. Animate this texture to simulate a melting cratered surface.

Volume Noise

Can be used to create many different types of effects.

You can find this texture in the Create bar. To apply this texture as a texture map, see ”Map a 2D or 3D texture” on page 74.

Threshold

The number added to the whole fractal, making it uniformly brighter. If some parts of the fractal are pushed up out of range (greater than 1.0), they are clipped to 1.0. If the Volume Noise is used as a bump map, it appears as plateau regions.

Amplitude

Scaling factor applied to all the values in the texture, centered around the texture's average value.

When you increase Amplitude, the light areas get lighter and the dark areas get darker.

If Volume Noise is used as a bump map, increasing Amplitude results in higher bumps and deeper valleys.

If set to a value greater than 1.0, the parts of the texture that scale out of range are clipped. On a bump map, they display as plateau regions.

Ratio

Controls the fractal noise frequency. Increase this value to increase fractal detail and make it finer.

Frequency Ratio

Determines the relative spacial scale of the noise frequencies. If not a whole number, the fractal does not repeat at the UV boundaries. For instance, a cylinder with default placement appears a seam.

Depth Max

Controls how much calculation is done by the Volume Noise texture. Since the Fractal texture process produces a more detailed fractal, it takes longer to perform. By default, the texture chooses an appropriate level for the volume being rendered. Use Depth Max to control the maximum amount of calculation for the texture.

Inflection

Applies a kink in the noise function. Useful for creating puffy or bumpy effects.

Time

Used to animate the Volume Noise texture. You can keyframe the Time attribute to control the rate and amount of change of the texture.

Frequency

Determines the fundamental frequency for the noise. As this value increases the noise becomes more detailed. It has the inverse effect of the scale parameter.

Scale

Determines the scale of the noise in the local X, Y, and Z directions. This is similar to scaling the transform node for the texture. When you increase Scale, the fractal detail seems to smear out in the direction you choose.

Origin

The zero point for the noise. Changing this value moves the noise through space.

Noise Type

Determines which noise to use during the fractal iteration. Select from the following:

Perlin Noise	The standard 3D noise used in the solidFractal texture.
Billow	A puffy, cloud-like effect.
VolumeWave	A sum of 3D waves in space.
SpaceTime	A 4-dimensional version of the Perlin noise, where time is the 4th dimension.

Density

Controls how many cells are embedded in the medium used by the Billow noise type.

At 1.0, the medium is completely packed with cells. Reduce this value to make the cells sparser. If the texture is used as a bump map, low values for Density results in smooth looking surfaces with occasional bumps.

Spottyness

Controls the density randomization of individual cells used by the Billow noise type.

When set close to 0, all the cells are the same density. As you increase Spottyness, some cells are randomly denser or thinner than others.

Size Rand

Controls the randomization of the size of the individual blobs used by the Billow noise type. When it is close to 0, all the cells are the same size. As you increase Size Rand, some cells are smaller than others, in a random fashion.

Randomness

Controls how the cells for the Billow noise type are arranged relative to one another. Set to 1.0 for a more natural random distribution of cells.

If set to 0, all the spots are laid out in a regular pattern. This can provide interesting effects when used as a bump map—for instance, you can make things like insect eyes, or machine-tooled raspy surfaces.

Falloff

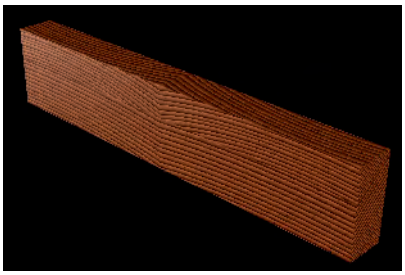
Controls the way intensity falls off for individual blobs for the Billow noise type. Select from the following:

Linear	A uniform falloff from the center to a value of zero at the edges of the blobs.
Smooth	More natural looking, using a gaussian falloff.
Fast	Focuses the intensity more towards the center of the blobs.
Bubble	Uses a reverse falloff, fading to zero at the blob center.

Num Waves

Determines how many waves to generate for the Volume Wave noise type. The larger the number, the more random-looking and slower the texture.

Wood



Simulates wood by projecting a 2D pattern. This pattern consists of concentric ring layers defined by *veins* and *filler*. When you map the Wood texture to a surface, the surface seems to be carved out of wood. When you map it to several surfaces, they seem to be carved from a single block of wood.

Find this texture in the Create bar. To apply this texture as a texture map, see "Map a 2D or 3D texture" on page 74.

Tips

- There are four Wood attributes that are frame constant, meaning that mapping them with textures or other nodes that produce different values from point to point may lead to unpredictable results. These attributes are: *Grain Spacing*, *Layer Size*, *Randomness*, and *Age*. You can key all of these attributes to make their appearance change over time in an animation sequence.
- If you use the Wood texture as a bump map, lower the Grain Contrast setting to reduce the potential for texture artifacts during animation.

Filler Color

The color of the space between veins. The vein color diffuses into the filler color. Double-click the color bar to choose a different color from the Color Chooser.

Vein Color

The vein color of the wood. The vein color diffuses into the filler color. Double-click the color bar to choose a different color from the Color Chooser.

Vein Spread

The amount of vein color that diffuses into the filler color. The valid range is 0 to infinity. The slider range is 0 to 3. The default is 0.25.

Layer Size

The average thickness of each layer or ring. The valid range is 0 to infinity. The slider range is 0 to 0.5. The default is 0.02. (The thickness of individual layers or rings is also influenced by the Randomness and Age values.)

Randomness

Randomizes the thickness of individual layers or rings. The range is 0 to 1. The default is 0.5.

Age

The age of the wood (in years). This value determines the total number of layers or rings in the texture, and influences the relative thickness of central and outer layers. The valid range is 0 to infinity. The slider range is 0 to 100. The default is 20.

Grain Color

The color of the random grain in the wood.

Grain Contrast

Controls the amount of Grain Color that diffuses into the surrounding wood color. The range is 0 to 1. The default value is 1.

Grain Spacing

The average distance between grain spots. The range is 0.002 to 0.1. The default value is 0.01.

Center

The location of the center of the texture's concentric rings in the U and V directions. The range is -1 to 2. The default values are 0.5 and -0.5.

Tip	Do not set the Center values less than -3 or greater than 3.

Noise Attributes (Wood)

The Wood texture creates a 3D texture by projecting a 2D pattern. The Noise Attributes control the randomization (using fractal noise) of the texture in the direction the pattern is projected. Select from the following:

Amplitude X, Amplitude Y

An average scaling factor applied to all values in the fractal noise in the texture's X and Y directions. The valid range is 0 to infinity. The range is 0 (no noise) to 1 (strong noise). The default value is 0.1.

Tip	The Wood texture renders faster if the Amplitude X and Amplitude Y values are both 0.

Ratio

Controls the fractal noise frequency. The range is 0 (low frequency) to 1 (high frequency). The default is 0.35.

Ripples

Determines the texture's waviness in the X, Y, and Z directions. The values represent the frequency scale of the fractal used to generate the texture. The range is 0 to 20. The default is 1.

Depth

The minimum and maximum number of iterations used to calculate the texture pattern. This parameter controls how fine grained the texture is. The range is 0 to 25. The default values are 0 and 20.

Shared 3D texture attributes

For texture-specific attributes, see the 3D texture name: Brownian, Cloud, Crater, Fluid Texture 3D, Granite, Leather, Marble, Rock, Snow, Solid Fractal, Stucco, Volume Noise, Wood.

Color Balance

Corrects the color or intensity of a texture.

Default Color

If you map a texture to a material in such a way that it that does not cover the entire surface, the file node's Default Color shows through. To select a different color, click the color bar to open the Color Chooser. To change the texture's coverage, use the placement options.

Color Gain

Scaling factor applied to the texture's outColor channel. For example, you can color-correct a texture that appears too green by setting the Color Gain to a shade of blue.The default color is white (no effect).

Color Offset

Offset factor applied to the texture's outColor channel. For example, you can brighten a texture that appears too dark by setting the Color Offset to a shade of grey. The default color is black (no effect).

Alpha Gain

Only has an effect if the texture is used as a bump or displacement. Scaling factor applied to the texture's outAlpha channel. The default value is 1 (no effect).

Alpha Offset

Only has an effect if the texture is used as a bump or displacement. Offset factor applied to the texture's outAlpha channel. For example, if the Alpha Gain value is -1 and the Alpha Offset value is 1, the outAlpha channel is inverted. The default value is 0 (no effect).

Alpha is Luminance

Off by default. The alpha (mask) output depends on the luminance of the color channels. Bright areas of the texture are more opaque when compositing, and dark areas are more transparent.

Note	You cannot use Alpha as Luminance for Cloth, Ramp, or Stencil textures.

Effects

Filter

Filter attributes scale the size of the filter and let you specify the amount of blur in the texture map. Use it as an anti-aliasing technique used to refine file textures, reduce flickering, or to achieve special effects.

By default, Filter is set to a value of 1.0 to help prevent such aliasing effects. The effect of Filter is related directly to eye space. As the object moves further away from the eye, the more the texture blurs.

For more information, see "Texture filtering" on page 34.

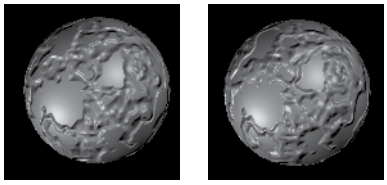
Filter Offset

Controls the texture blur in texture space (not eye space). Use Filter Offset for a blurred effect instead of anti-aliasing. Maya adds a constant value to the Filter setting. The default value is 0. Increasing the value increases the texture blur. For example, 1.00 completely blurs the texture.

Tip	A Filter and Filter Offset of 0.00 results in no blur effect, but a small amount of blur can help reduce moiré and aliasing effects in texture maps.

Invert

Reverses all texture colors (black becomes white, white becomes black, and so on). Invert is off by default. For example, you can change a bump or displacement map's raised regions to depressions and vice versa by setting Invert on or off.



Local, Wrap

Wrap repeats or tiles the texture completely over the object. If off, everything outside the 3D placement cube displays the texture's default color. Wrap is on by default.

Tip	Some nodes, such as the Reverse utility, repeat themselves to achieve the effect of Wrap, so that it extends infinitely. Others, such as a "Marble" texture, extend outwards without repeating.

To adjust texture placement on all objects at once, turn Local on, transform the texture placement icon, then turn Local off to see the results. Turning on Local also means that if you transform any of the objects during an animation, the 3D texture transforms accordingly.

Blend

Controls how much of the texture's Default Color is mixed into the texture Color. A value of 0 means the Default Color does not affect the texture Color. As you increase the Blend value, more and more of the Default Color mixes in. *This attribute does not work unless Wrap is turned off and Local is turned on*.

To blend colors and textures using the Blend slider

1. Change the Default Color (in the Color Balance section of the texture's Attribute Editor), or map another texture to the Default Color.
2. Make sure Invert and Wrap are off and turn Local on.
3. Drag the slider to change the Blend value.

Color Remap

Applies a color map to the texture and lets you add or subtract colors from a texture's default settings. Maya maps the U value to the original texture's hue, and the V value to the original texture's intensity. (Color Remap is similar to the "Shading Map" on page 336 material and uses the Rgb to Hsv Color Utility.)

To remap a texture

Click the Color Remap button. The texture colors change and a Remap Ramp Attribute Editor appears. Adjust the Ramp texture colors and attributes if necessary.

UV Coord

The current UV coordinate values of the current sample point.

Environment textures

About environment textures

Maya provides environment textures for use as backgrounds for your scene. Environment textures available in the Create Render Node window include: Env Ball, Env Cube, Env Sphere, etc. For more information regarding a specific attribute, see the following:

- ”Env Ball” on page 408
- ”Env Chrome” on page 410
- ”Env Cube” on page 412
- ”Env Sky” on page 412
- ”Env Sphere” on page 417

For attributes shared among environment textures, see

- ”Common Environment texture attributes” on page 408.

Common Environment texture attributes

Color Remap

Color Remap applies a color map to the texture. It is the only common Effects Environment texture attribute. The U value of the Color Remap texture is mapped to the original texture’s hue, and the V value is mapped to the original texture’s intensity (the value defined by [R+G+B]/3). The Color Remap attribute acts similar to the Shading Map material (see Shading Map).

Env Ball

Uses an image of a highly reflective chrome ball in an environment (real world or computer generated) to re-create that environment. This is possible because the reflections in the chrome ball provide a (nearly) 360 degree view of the environment.

An Env Ball texture background renders faster than a procedural texture background or a background modeled with surfaces. You can therefore replace a complex background with an Env Ball texture (by rendering an image of a chrome ball in that environment) to reduce rendering times.

Find this texture in the Create bar. To use this texture, see ”Simulate reflections with Env Ball” on page 137.

Image

The texture used by the Env Ball texture. To use a single image of a highly reflective chrome ball in an environment, map a File texture to the Env Ball texture's Image attribute, and then specify an image file for the File texture's Image Name attribute.

Inclination

The rotation (in radians) of the ball image about the vertical axis. The valid range is 0 to 3.142. The slider range is 0 to 3.142. The default setting is 0.

Set the Inclination value to the inclination of the camera (the angle between the camera's view and the environment's YZ plane) used to generate the image file (by photographing or rendering a reflective ball in an environment). For example, if the camera is parallel to the YZ plane, set the Inclination value to 0. When creating the ball image, a camera inclination and elevation of zero provides the best resolution for the view you intend to use.

Elevation

The rotation of the ball image about the horizontal axis. The valid range and the slider range are both -1.571 to 1.571. The default setting is 0.

Set the Elevation value to the elevation of the camera (that is, the angle between the camera's view and the environment's grid plane: XZ plane for a Y-up scene) used to generate the image file (by photographing or rendering a reflective ball in an environment). For example, if the elevation of the camera is 90 degrees (that is, it is directly above the ball), set the Elevation value to 1.571. If the camera is parallel to the grid plane, set the Elevation value to 0. When creating the ball image, a camera inclination and elevation of zero provides the best resolution for the view you intend to use.

Eyespace

Causes the position of the Env Ball texture's Image file to be defined relative to the window, not the camera view.

If Eyespace is on, the Env Ball texture's Image file automatically matches the environment's Backdrop image file (provided they were both originally photographed/rendered from the same point of view), even if the camera view changes. Reflections, however, are based on the background being infinitely far away; that is, the reflection planes are ignored (see "Projection Geometry"). Rendering is faster when Eyespace is on. The default setting is off.

Reflect

Causes the Image file to be reflection mapped onto the background.

If Reflect is off, the Image file is mapped using a solid texture spherical projection. This allows you to model the geometry of the background image and then map the background image to this geometry, for example, to add shadows, lighting effects, or fog to the scene. The default setting is on.

Projection Geometry

The Projection Geometry attributes controls the appearance of reflections from an Env Ball texture. They define the location of the sky and, or room walls of the original environment so that Maya can calculate reflections on surfaces in the re-created environment.

For example, if the original environment consisted of a grid plane and a sky, then you would set the Sky Radius value to the radius of the sky, and the Bottom value to the distance between the grid plane and the reflective ball. If the original environment consisted of a room, then you would set the Bottom, Top, Left, Right, Front, and Back values to the distance between each wall and the reflective ball.

In some cases you may want to use values different than the original environment. For example, instead of using the Bottom, Top, Left, Right, Front, and Back values to define the walls of a room, you may simply use the Sky Radius attribute. Because Sky Radius defines a sphere, reflections on surfaces in the simulated environment are smoother and less likely to become blurred. You can also combine Sky Radius with Bottom, Top, Left, Right, Front, and, or Back.

Sky Radius

The radius of the sky of the original environment. The valid range is 0 to infinity. The slider range is 0 to 20. The default value is 0.

Bottom, Top, Left, Right, Front, Back

The distance between the reflective ball and each wall of the original environment. The valid range is 0 to infinity. The slider range is 0 to 20. The default value is 0.

Env Chrome

Simulates a showroom environment. The texture consists of a plane and a sky plane (with fluorescent style light rectangles), and provides a simple but effective environment to simulate reflections off chrome surfaces.

The Environment Chrome Attributes control the size and placement of the simulated fluorescent lights in an Env Chrome texture. (These “lights” produce reflections in surfaces, but they do not actually illuminate surfaces.)

Find this texture in the Create bar.

Light Width, Light Depth

The width and depth of each light. These parameters also determine spacing between lights. The valid/slider range is 0 to 1. The default Light Width value is 0.5 and the default Light Depth value is 0.1.

Light Width Gain, Light Width Offset

The number of lights per unit length. The valid/slider range is 0 to 1. The default Light Width Gain value is 1 and the default Light Width Offset value is 0.

Light Depth Gain, Light Depth Offset

The light displacement. The slider range is 0 to 1. The default Light Depth Gain value is 1 and the default Light Depth Offset is 0.

Sky Attributes

Sky Color

The color of the sky at the horizon. Overall sky color is linearly interpolated between Sky Color and Zenith Color.

Zenith Color

The color of the sky at the zenith (straight up). Overall sky color is linearly interpolated between Sky Color and Zenith Color.

Light Color

The color of the simulated fluorescent lights. These “lights” produce reflections in surfaces, but they do not actually illuminate surfaces.

Floor Attributes

Floor Color, Horizon Color, Grid Color

The color of the floor, the floor’s horizon and the floor’s grid.

Real Floor

If Real Floor is off, the environment’s floor is located at infinity, so reflections on moving objects and, or reflections viewed from a moving camera are incorrect.

If Real Floor is on, the floor is located relative to the grid plane (based on the Floor Altitude value), so reflections on moving objects and, or reflections viewed from a moving camera are correct. If Real Floor is on, make sure surfaces and, or the camera do not go below the grid plane. Real Floor is on by default.

Floor Altitude

The height of the floor relative to the grid plane. Floor Altitude has no effect if Real Floor is off. The slider range is -1 to 1. The default value is -1.

Note	If you set the Floor Altitude too high, the texture swatch becomes red, indicating that the camera is looking under the floor, which you probably do not want. Lower the Floor Altitude until the red color disappears.

Grid Placement

Grid Width, Grid Depth

The width and depth of the grid lines. These attributes also determine the spacing between grid lines. The valid/slider range is 0 to 1. The default value is 0.1.

Grid Width Gain, Grid Depth Gain

The number of grid cells per unit length. The valid/slider range is 0 to 1. The default value is 1.

Grid Width Offset, Grid Depth Offset

The grid displacement. The slider range is 0 to 1. The default value is 0.

Env Cube

Simulates an environment by mapping six image files onto the inner surfaces of a large (or infinitely large) cube.

Use Env Cube to make reflections on a moving surface during an animation if you do not have time to raytrace because it treats the texture placement box as the geometry of the environment. This means changes in the relative size and position of camera, surface, and environment are respected.

For example, you can fake a nice reflection on the surface of an animated shiny car as it drives down a road. This process is known as *reflection mapping*.

Find this texture in the Create bar. To use this texture, see ”Simulate reflections with Env Cube” on page 138.

Infinite Size

When on, the images in the cube are reflected as though the sides of the cube were infinitely far away. If you are using images with distance, such as the horizon or a starfield, turn on Infinite Size. If the images are of the interior of a room, or nearby objects, leave Infinite Size off.

Right, Left, Top, Bottom, Front, Back

The image files mapped to the right, left, top, bottom, front, and back inner surfaces of an infinite cube. (The front of the cube faces the front orthographic view.)

Env Sky

Simulates a planetary environment viewed from the surface of a planet.

Find this texture in the Create bar.

Note	If the eye point or view drops below the floor, the Env Sky texture swatch turns red as a warning. If you render the scene, the floor appears red. To avoid this, make sure the eye point is always above the floor (the grid plane).

Environment Sky Attributes

Total Brightness

The overall brightness of the environment. The valid range is 0 to infinity. The slider range is 0 to 5. The default is 1.

Sun Attributes

Sun Brightness

The color and brightness of the sun. The default color Value is 0.5.

Halo Brightness

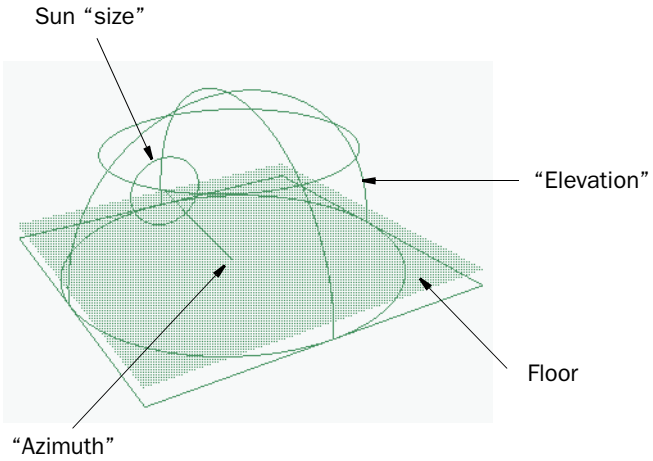
The color and brightness of the halo around the sun. The default color value is 0.1.

Interactively adjusting Sun attributes

The following attributes relate directly to the Sky's texture placement object. You can use the Maya transform tools, such as Scale and Rotate to place the manipulator, or use the Show Manipulator tool.

As you change the settings for Elevation, Azimuth, and Size attributes, notice how the various manipulators adjust in the View. IPR render to watch the texture change on the object.

The following indicates which manipulators correspond to which attribute.



Elevation

The angle (in degrees) of elevation of the sun relative to the floor. The valid range is -90 to 90. The slider range is 0 (sunrise/sunset) to 90 (midday). The default value is 45.

Azimuth

The angle (in degrees) of the sun in the sky about a vertical vector. The valid range is 0 to 360. The slider range is 0 to 360. The default value is 145.

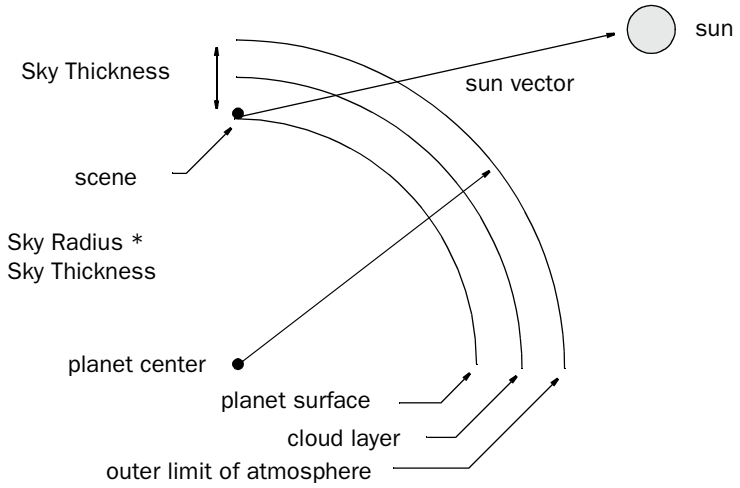
Size

The size (radius) of the sun. The valid range is 0 to 10000. The slider range is 0 to 20. The default value is 0.531

Blur

The size (radius) of the halo around the sun. The valid range is 0 to 1000. The slider range is 0 to 20. The default value is 1.

Atmospheric Settings



Sky Brightness

A scaling factor applied to the sky color. The default color Value is 0.5.

Air Density

The density of the air in the atmosphere. The denser the air, the more light is scattered.

Air density represents low and high altitudes. High altitude skies are almost black straight up and blue near the horizon (the Air Density value less than 1). Low altitude skies are blue straight up and white near the horizon (the Air Density value greater than 1). The slider range is 0 to 3. The default value is 1.

Dust Density

The density of dust in the atmosphere. The slider range is 0 to 3. The default value is 0.

Sky Thickness

The thickness of the atmosphere. The valid range is 0 to infinity. The slider range is 0 to 10000. The default value is 1000.

Sky Radius

The outer radius of the sky as a multiple of Sky Thickness.

Sky Thickness and Sky Radius values determine the planet radius, and planet radius influences the appearance of sunsets. A planet with a large radius results in very red (and very dark) sunsets (you can adjust Sky Bright to compensate for sunsets that are too dark). The valid range is 0 to infinity. The slider range is 0.01 to 300. The default value is 50.

For example, if Sky Thickness is 1000 and Sky Radius is 50, the outer radius of the sky is 1000 x 50 = 50 000 units, and the radius of the planet is (1000 x 50) - (1000 x 1) = 49 000 units.

Floor Attributes

Has Floor

Turns the floor on or off. If Has Floor is off, the environment below the horizon is a mirror image of the environment above the horizon.

Floor Color

The color of the floor. The default color value is 0.392.

Floor Altitude

The height of the floor relative to the grid plane. Floor Altitude has no effect if Has Floor is off. The slider range is -100 to 100. The default value is -10.

Cloud Attributes

Use Texture

Controls whether or not Env Sky pays attention to the Cloud Texture attribute. If you attach a Cloud or other fractal texture node to the Cloud Texture attribute, then you must turn on Use Texture to see the results.

Cloud Texture

The texture that determines cloud distribution in the sky. For example, the Fractal texture creates very realistic clouds. By default, there is no cloud texture map (and no clouds).

Cloud Brightness

The brightness and color of cloud illumination from ambient scattered light in the atmosphere. (The amount of ambient light depends on the Elevation value.) The default color Value is 0.5.

Sunset Brightness

The brightness and color of cloud illumination when the sun is below the horizon and the clouds are front lit (for example, when the sun's Elevation value is 0 and its Azimuth value is 180).

This is a very subtle effect and occurs only briefly in nature during a sunrise or sunset. The effect is more noticeable with high altitude clouds. The default color Value is 1.

Density

The density of individual clouds. The valid range is 0 to infinity. The slider range is 0 (no clouds) to 5 (heavy clouds). The default value is 1.

Threshold

A threshold value for the Cloud texture that controls how much of the sky is covered with cloud.

As the Threshold value increases, darker areas of the texture do not produce clouds. The valid range is 0 to infinity. The slider range is 0 (entire sky is cloudy) to 1 (no clouds). The default value is 0.5.

Power

The clouds are scaled and positioned by adjusting the Power value.

The cloud density is achieved by subtracting the Threshold from the pixel value clipping to 0, then multiplying the result with Density. To control the amount of de-focusing of the Cloud Texture, adjust the Blur value (under Sun Parameters). The valid range is 0 to infinity. The slider range is 0 to 1. The default value is 1.

Altitude

The height of the clouds.

The Altitude value does not greatly affect the position of the clouds. Instead, it determines how much the atmosphere obscures the clouds near the horizon. Low altitude clouds disappear into haze much more slowly than high altitude clouds. The valid/slider range is 0 to 1. The default value is 0.2.

Halo Size

The size (radius) of cloud illumination from direct back lighting by the sun (for example, when the sun's Azimuth value is 0).

Direct back lighting is most noticeable near the edges of thick clouds or through thin clouds. The valid range is 0 to infinity. The slider range is 0 to 50. The default value is 20.

Calculation Quality

The Calculation Quality attributes control the rendering speed of an Env Sky texture.

The calculations required for curved atmospheres reduce speed. The Calculation Quality attributes do not greatly affect the appearance of the sky, but do affect the speed at which the calculations are computed.

Sky Samples

The number of samples used above the cloud layer. Set the Sky Samples value to 1 for maximum speed. The valid range is 0 to 20. The slider range is 0 to 3. The default value is 5.

Floor Samples

The number of samples used by the atmosphere between the eye and the horizon.

Increasing the Floor Samples value increases the effect of the atmosphere along the floor. The valid range is 0 to 20. The slider range is 0 (no atmosphere between the eye and horizon) to 3. The default value is 1.

Cloud Samples

The number of samples used below the cloud layer. The valid range is 0 to 20. The slider range is 0 (clouds do not fade to mist at the horizon) to 3. The default value is 5.

Env Sphere

Simulates an environment by mapping a texture or image file directly onto the inner surface of an infinite sphere.

Find this texture in the Create bar. To use this texture, see "Simulate reflections with Env Sphere" on page 139.

Image

The texture mapped to the inner surface of an infinite sphere.

Shear U

Shears the Image texture in the U direction. For example, horizontal stripes resemble a barber pole when sheared. The slider range is -10 to 10. The default value is 0.

Shear V

Shears the Image texture in the V direction. For example, concentric lines at the poles spiral inward when sheared. The slider range is -10 to 10. The default value is 0.

Flip

Reverses the U and V orientation of the Image texture.

Other textures

Layered texture

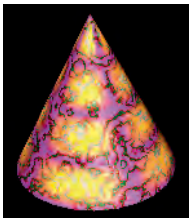
For more information on layered textures, see ”Layered textures” on page 30.

Find this texture in the Create bar.

Layer is Visible

Specifies whether the layer should be taken into consideration during computation of the result color and alpha of the layered texture. If off, it is as if the layer does not exist. Use this when you want to isolate a particular layer to see how it looks by itself.

Layer is Visible on



Layer is Visible off



Alpha is Luminance

Lets you determine whether the Alpha should be the luminance of the Out Color, as with other 2D textures, such as a File texture.

Automatic Alpha for File and Layered Texture nodes

Hardware Color

Specifies which color objects using this texture display in the view while in hardware shading mode (not hardware texturing mode).

Blend modes

Layers can be blended with those below them using the Texture Blend attribute in the Layered Texture's Attribute Editor.The Blend Mode specifies how the selected layer blends with the below it. The following lists the blend modes:

None Edits or paints each pixel to make it the result color. This is the default. (Normal mode is called Threshold when you're working with a bit mapped or indexed-colored images).

Over The top layer is applied like a decal to the following layer. The shape of the decal is determined by the top alpha.

In The background texture is cut in the shape of the foreground alpha.

Out The result is the opposite of In. It is as if the shape of the foreground layer has been cut out of the background alpha.

Add The result color is the foreground color added to the background color as if being projected on the background through a slide projector. The result color is then applied over the background color using the foreground alpha to define the opacity of the result.

Subtract The result color is the foreground color subtracted from the background color. The result color is then applied over the background color using the foreground alpha to define the opacity of the result.

Multiply Looks at the color information in each layer and multiplies the bottom color by the blend color. The result color is always a darker color. Multiplying any color with black produces black. Multiplying any color with white leaves the color unchanged.

Difference Looks at the color information in each layer and subtracts either the blend color from the bottom color or the bottom color from the blend color, depending on which has the greatest brightness value. Blending with white inverts the bottom color values; blending with black produces no change.

Lighten Looks at the color information in each layer and selects the bottom or blend color, whichever is lighter, as the result color. Pixels darker than the blend color are replaced, and pixels lighter than the blend color do not change.

Darken	Looks at the color information in each layer and selects the bottom or blend color, whichever is darker, as the result color. Pixels lighter than the blend color are replaced, and pixels darker that the blend color do not change.
Saturate	Creates a result color with the luminance and hue of the bottom color and the saturation of the blend color.
De-saturate	The result color is the background color with saturation decreased in proportion to the foreground color scaled by foreground alpha. If the foreground color is red, for example, the resulting color is the background color with desaturated reds.
Illuminate	Creates a result color with the hue and saturation of the bottom color and the luminance of the blend color. This mode creates an inverse effect from that of the Color mode.

Placement nodes

Place 2d Texture

Defines a texture frame—a rectangular area on a surface (in the UV coordinate space) in which the texture appears. You can control the position, size, and rotation of this frame on the surface using the “Coverage”, “Translate Frame”, and “Rotate Frame” attributes. You can also control how the texture is tiled within the frame using the “Repeat UV”, “Rotate UV”, “Offset”, “Mirror U, V”, “Stagger”, and “Wrap U, Wrap V” attributes.

The two columns of boxes in the Attribute Editor represent U and V values.

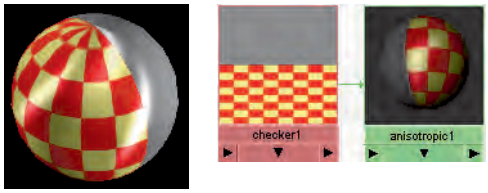
Interactive Placement

Displays the texture placement manipulator. Either click this button from the Attribute Editor, or click the Texture Placement Tool icon in the main window and select the surface. Middle-drag the manipulator handles to place the texture.

Coverage

Specifies what ratio of the surface the texture map covers. The valid range is 0 to + infinity for NURBS surfaces. A value of 1 (the default) covers the entire surface in either the U or V direction.

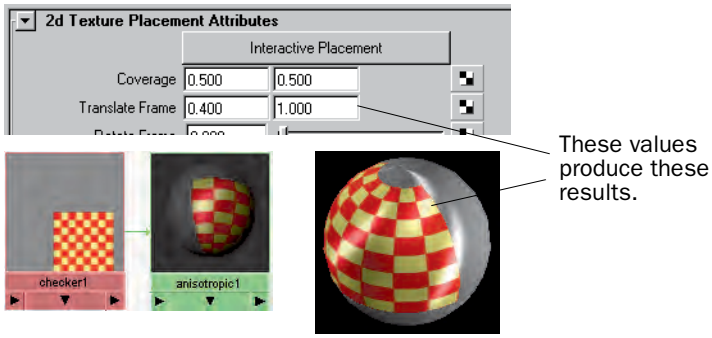
For example, to cover half the surface, set the value at 0.5 in both the U and V directions.



U = 1.0, V = 0.5

Translate Frame

The Translate attributes position the texture map on the surface and move the coverage area across the surface. The range is from - infinity to + infinity.



Rotate Frame

Rotates the texture map on the surface. This attribute is represented in degrees.

Mirror U, V

Only works when U Repeat or V Repeat attributes are greater than 1. Mirror in the U and V direction separately. When on, the repeat areas are mirrored—rows of images display as mirrored images of themselves. This helps to disguise the effect of seams between repeat areas.



Default File 2D texture placement.



After you select Mirror and place the texture.

Stagger

Maya offsets repeats of maps making alternate rows of repeats offset exactly by half (like brick walls). When off, the repeats line up horizontally and vertically.

Wrap U, Wrap V

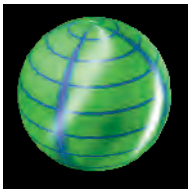
Wrap U and Wrap V attributes control whether a map is repeated in U or V directions, or both U and V. Both the Wrap attributes are on by default. Turn these off to prevent seams from showing on a closed surface, such as a cylinder or sphere, or to prevent the texture from duplicating itself when you use Translation and Coverage attributes to limit the mapping to a very specific surface area.

Repeat UV

Specifies how many copies of the texture map are mapped within the coverage area along either the U or V directions (depending on the texture). By default, Maya maps one copy of the texture. Values greater than 1 result in more copies of the map displayed in the same coverage area. Values less than 1 result in only a portion of the map displayed.



Repeat:
U = 4
V = 4



Repeat:
U = 10
V = 4

Offset

Offsets the pattern of the texture map. This can be particularly useful when fine-tuning the placement of a pattern on a surface. U Offset offsets the texture pattern along the U direction and V Offset along the V direction. Each value ranges from - infinity to + infinity.

Rotate UV

Since you cannot use the interactive tool to rotate surface placement, use this attribute. Rotate UV is calculated in degrees. The valid range is 0 to 360 degrees.

Noise UV

2D noise for U and V. Displaces the colors of the texture map.

Fast

When on, Fast checks if the placement is the default and all shading-time evaluations perform less computations. Turn Fast on to slightly improve rendering speed. Fast is off by default.

mental ray for Maya shaders

mental ray for Maya nodes

For more information about mental ray for Maya nodes (shaders), see ”mental ray for Maya custom shaders” on page 162.

Materials

All mental ray for Maya materials include Hardware Texturing attributes, allowing you to preview them in the scene view. For a description of the Hardware Texturing attributes, see ”Hardware Texturing” on page 349.

dgs_material

This shader can simulate mirrors, glossy paint or plastic, anisotropic glossy materials such as brushed metal, diffuse materials such as paper, translucent materials such as frosted glass, and any combination of these.

Note	This shader cannot be used as a shadow shader.

For a full description of this node’s attributes, see the *mental ray Shaders Guide* in the Maya Help.

dielectric_material

This shader is a physically based material shader that can be used to simulate dielectric media such as glass, water, and other liquids.

The shader uses Fresnel's formulas for dielectric interfaces. This means that most light is transmitted through the surface for perpendicular incident directions while most light is reflected by the surface for grazing incident angles, simulating the behavior of real dielectric materials.

The shader also uses Beer's law for absorption of light that passes through a medium. This means that the light is subject to an exponential falloff as it is transmitted between two surfaces with dielectric material.

Two types of dielectric interfaces are supported: dielectric-air simulates the interface between a dielectric material and air (such as glass-air), and dielectric-dielectric simulates the interface between two dielectric materials (such as glass-water). To achieve physically correct simulations it is important to use the correct surface interfaces.

This shader cannot be used as a shadow shader.

For a full description of this node’s attributes, see the *mental ray Shaders Guide* in the Maya Help.

mi_car_paint_phen

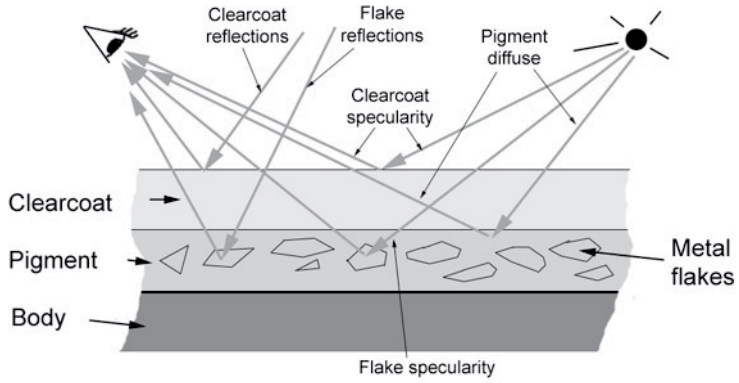
Use this shader to fully achieve the look of car paint. This shader combines the functionality of the mi_metallic_paint, mib_glossy_reflection, and mi_bump_flakes shaders into one.



Car model using mi_car_paint_phen.

Image by Tim Wong

The diagram below illustrates the qualities that the car paint phenomenon shader simulates.



Cross-section of car paint

Diagram courtesy of mental images.

The car paint phenomenon shader also includes the following:

- diffuse reflection in the pigment layer, with color shift
- specular highlights from light sources in the metallic flakes
- optional ray traced reflections in the metallic flakes
- a clear coat layer, with mirror or glossy reflections and specular highlights and an optional glazing mode
- specular highlights from light sources in the clear coat, with an optional glazing mode
- a dirt layer to simulate an “unwashed” appearance on the surface

For a full description of this shader, see the *mental ray Shaders Guide* in the Maya Help.

mi_metallic_paint

Use this shader to simulate a high-gloss, smooth paint finish like car paint. This shader simulates the thin pigment layer of car paint, and the tiny metallic particles (flakes) that are suspended within the pigment layer. To achieve the glossy reflections of a clearcoat, and the glittering effect of flakes, combine this shader with the mib_glossy_reflection shader and the mib_bump_flakes shader (see ”Textures” on page 430).

For a full description of this shader, see the *mental ray Shaders Guide* in the Maya Help.

mia_material

New

Use this shader to simulate materials used in architectural and product design renderings. You can use this shader to create a physically accurate representation of hard-surface materials such as metal, wood and glass. This shader is optimally tuned for fast glossy reflections and refractions and high-quality glass.

This shader provides many features:

- It is “energy conserving”, ensuring that diffuse+reflection+refraction<=1. This helps create more natural or photoreal results.
- supports the BRDF (Bidirectional Reflectance Distribution Function), where the reflectivity of a surface is view angle dependent.
- transparent or translucent objects can be treated as solid (refracting, built out of multiple faces) or thin (non-refracting, can use single faces). This helps to simplify modeling and reduce rendering times.
- built in ambient occlusion for contact shadows and enhancing small details.
- diffuse attribute that uses the Oren_Nayar shading model and allows you to create a “powdery” look for your surface.

- advanced features for glossy reflections such as interpolation, emulated glossiness, and importance sampling to enhance performance.
- supports anisotropic reflections and refractions.
- indirect illumination control. Sets the final gather accuracy or indirect illumination level on a per-material basis.

For a full description of this shader, see the *mental ray for Maya architectural shaders* document.

mib_glossy_reflection

Use this shader to create glossy and blurred reflections on the surface of a base material. This can be any type of material shader. This shader offers multi-sampled glossiness, distance-bounded reflections, and Fresnal effects.

For a full description of this shader, see the *mental ray Shaders Guide* in the Maya Help.

mib_glossy_refraction

Use this shader to create glossy and blurred refractions on the surface of a base material. This shader is made up of three layers; a top material, back material, and a deep material that define the characteristics of the refraction from the exterior, interior, and within the surface.

For a full description of this shader, see the *mental ray Shaders Guide* in the Maya Help.

mib_illum_blinn

Perform Blinn illumination, which is a like Cook-Torrance illumination (see ”mib_illum_cooktorr” on page 426) but without the color shift with angles. It only requires one index of refraction.

For a full description of this node’s attributes, see the *mental ray Shaders Guide* in the Maya Help.

mib_illum_cooktorr

Perform Cook-Torrance illumination, given ambient, diffuse, and specular RGB colors, a roughness, index of refraction for three wavelengths, and a light list. With this, you can produce silk-type highlights.

Cook-Torrance illumination has an off-specular peak and a color shift with angles.

For a full description of this node’s attributes, see the *mental ray Shaders Guide* in the Maya Help.

mib_illum_hair

This has a fine-tuned sheen-like specular highlight that produces sub-pixel anti-aliasing, which helps to render high-quality thin strips, such as hair.

For a full description of this node’s attributes, see the *mental ray Shaders Guide* in the Maya Help.

mib_illum_lambert

Perform Lambertian illumination, given ambient and diffuse RGB colors (alpha is ignored).

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

mib_illum_phong

Perform Phong illumination, given ambient, diffuse, and specular RGB colors, a specular exponent.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

mib_illum_ward

Perform Ward illumination, given ambient, diffuse, and glossy RGB colors, two shinyness parameters, two direction vectors (from a texture). Useful to produce anisotropic effects. See also "mib_illum_ward_deriv" on page 427.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

mib_illum_ward_deriv

Perform Ward illumination, given ambient, diffuse, and glossy RGB colors, two shinyness parameters. Differs from mib_illum_ward in that the brushing directions are taken from the surface derivatives.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

Path_material

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

Transmat

This doesn't alter the ray; instead the ray passes through the material (the material is invisible). Use it to create volumetric or participating media effects.

For a full description of this node's attributes, see the mental ray Shaders Guide in the Maya Help.

Shadow shaders

Shadow shaders determine the appearance of shadows cast from an object. This is similar to the Shadow Color attribute on Maya light sources.

Shadow shaders can only be attached to the appropriate input in the Shading Group. Shadow shaders are special in that their result color is also an input color, which means that the output cannot be attached to another shader parameters because such attachments are one-way, output-to-parameter only.

They are referenced when a shadow ray hits an occluding object; the shadow shader of the occluding object controls how much light is transmitted.

In a Phenomenon, shadow shaders can only be attached to a material inside the Phenomenon, or to the Phenomenon root if the Phenomenon is attached to a material's shadow shader.

mib_shadow_transparency

The transparency shadow shader can be used to assign a (possibly transparent) color to an object, and to make it transparent for shadow rays. Either a color alpha < 1 or a nonzero transparency cause shadow rays to be transmitted through the object.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

Volumetric materials

Volume shaders can be assigned to particular objects by connecting to the object's Shading Group.

This controls the appearance of fog or other volumetric effects inside those objects. In mental ray for Maya you can also specify a global volume shader to control the appearance of fog outside of the objects in the scene (corresponds to Maya's Environment Fog). In mental ray for Maya, the global volume shader is assigned by connecting to the Volume Shader attribute in the mental ray section of the camera's Attribute Editor.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

mib_ray_marcher

The ray marcher casts light rays from points on a given ray, and approximates the volumetric contribution from light sources sending light through the volume.

Instead of using shader interface functions like mi_sample_light, it calls a shader given as an input parameter of type shader. Ray marching consists of calling the shader for regular points between the start point and end point of the ray, and adaptively subdividing each of these intervals until a given subdivision limit is reached if the color returned by two adjacent samples is smaller than a given contrast threshold. The total weighted sum is returned.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

mib_volume

A simple volume shader that simulates volume in a linear direction by receiving samples from the ray marcher.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

parti_volume

This is an advanced volume shader for simulating volume, such as fog, clouds, silty water, and similar media by scattering, absorbing, transmitting as the light travels through the volume.

The volume shader parti_volume can simulate homogeneous (uniform density) and nonhomogeneous participating media with isotropic (diffuse) or anisotropic scattering. parti_volume and parti_volume_photon use a two-lobed scattering model, which means that light scatters both forward and back in the incoming light direction.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

Displacement shaders

These shaders (not supplied with Maya) can be used to add new details to a surface prior to rendering.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

Photonic materials

Photon shaders control the reflection, transmission (refraction), and absorption of light for caustics and global illumination.

Advanced users can use these materials to simulate physically correct lighting situations.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

dgs_material_photon

dgs_material_photon is the photon shader that matches dgs_material. It has the same parameters; however, it respects photons and uses global illumination to illuminate objects.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

dielectric_material_photon

dielectric_material_photon is the photon shader that matches dielectric_material. It has the same parameters; however, it respects photons and uses global illumination to illuminate objects.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

mib_photon_basic

This is the basic photon shader that supports diffuse reflection and specular reflection and transmission/refraction. Use it to reflect, transmit, and absorb photons for global illumination and caustic effects.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

parti_volume_photon

parti_volume_photon is the photon shader that matches parti_volume. It has the same parameters; however, it respects photons and uses global illumination to illuminate objects.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

transmat_photon

transmat_photon is the photon shader that matches transmat. It has the same parameters; however, it respects photons and uses global illumination to illuminate objects. It simply traces a photon further in the direction it came from.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

Textures

Use texture shaders to apply image files on materials, generate procedural textures, or determine texture placement.

All textures in this section are File Texture based.

mentalrayVertexColors

For use in a shading network for rendering color per vertex in mental ray for Maya. You can store shading and lighting information on mesh vertices (rather than shading networks), simplifying your scene and making it more efficient to render.

For more information, see "Render color per vertex in mental ray for Maya" on page 186.

mi_bump_flakes

Use this shader to create the effect of tiny metallic particles suspended in a pigment layer. This is most commonly used for car paint, so that the flakes reflect light and can be seen glittering on a sunny day. Use the mib_bump_flakes shader with the mib_glossy_reflection, and mib_metallic_paint shader (see "Materials" on page 423).

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

mia_roundcorners

New

Use this shader to avoid the hard CG look where the edges of objects appear geometrically sharp. In the real world, edges are usually slightly rounded or filletted in some way. This shader creates an illusion of *rounded edges* at render time by perturbing the normal vector. This shader is not displacing or modifying the geometry, but is merely a shading effect (like bump mapping) and should be applied where bump maps are normally used (for example, in the Bump Mapping field of a shader). This shader is best used for straight edges and simple geometry rather than advanced highly curved geometry.

For a full description of this shader, see the *mental ray for Maya architectural shaders* document.

mib_amb_occlusion

Use this shader to calculate how ambient light affects the scene. Use it to add more realism in a more efficient way than traditional global illumination.

The output_mode option defines the returned color for the mib_amb_occlusion node.

-1	Standard occlusion behavior. No bending of normals.
0	Standard occlusion behavior. Normals are bent towards area of most exposure. The bent normal is used for the internal calculation of the "bright" and "dark" colors only. When calculation is complete, the normal is returned to its original value.
1	Enables environment sampling. The color returned is a result of the following: average of colors sampled from the environment map * bright color + dark color.
2	Bent normals are enabled and calculated in world space and returned as RGB values where red=x, green=y, and blue=z. Note that in this mode, the normals stored on the surface are not bent. Instead, the bent normals are the output of this shader.

3	Bent normals are enabled and calculated in camera space and returned as RGB values where red=x, green=y, and blue=z. Note that in this mode, the normals stored on the surface are not bent. Instead, the bent normals are the output of this shader.
4	Bent normals are enabled and calculated in object space and returned as RGB values where red=x, green=y, and blue=z. Note that in this mode, the normals stored on the surface are not bent. Instead, the bent normals are the output of this shader.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

mib_bent_normal_env

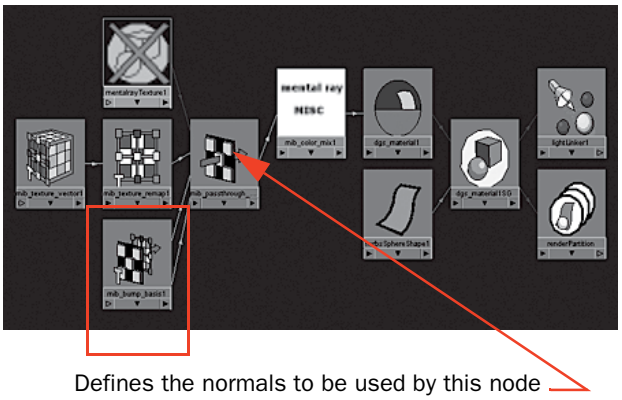
Use this shader to accelerate rendering when you want the look of global illumination or final gathering lit by an environment. A bent normal is the average unoccluded direction vector from a surface point. For a completely unoccluded surface, the bent normal is the same as the normal vector. For an occluded surface, the bent normal points in the direction with the least amount of occluding geometry.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

mib_bump_basis

Defines the normals to be used by mib_bump_map or mib_passthough_bump_map.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.



mib_bump_map

Apply a File Texture with mib_bump_basis o the normal vector by evaluating the texture at multiple points to compute U and V gradients that are multiplied with the basis vectors, combined with the original normal, normalized, and written back.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

mib_bump_map2

Use this shader to create a bump effect that is driven by a file texture. Unlike the mib_bump_map shader, you can set a Scale and Color value. This shader is useful for creating a bump effect with mental ray custom shaders, by creating a shading network as follows:

A material shader is connected to `mib_bump_map2.color`

A `mentalrayTexture` node is connected to `mib_bump_map2.texture`

`mib_bump_map2.message` is connected to a `SG.miMaterialShader` node

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

mib_fg_occlusion

Use this shader to have occlusion calculated by final gathering, using the scalar occlusion value (a gray scale value). This provides some flexibility because the occlusion is calculated by final gathering, when final gathering is turned on. However, when final gathering is turned off, the occlusion is calculated by the mib_amb_occlusion node.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

mib_passthough_bump_map

This is the same as mib_bump_map, but the normals return to the original values after the bump mapping is complete.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

mib_texture_checkerboard

Divide the unit cube into eight subcubes, each with a separate RGBA color. Use it to generate stripes and 2D or 3D checkerboards.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

mib_texture_filter_lookup

Looks up of texture image using elliptical filtering. Use it to reduce flickering (moire patterns) or aliasing on a specific surface that has a texture.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

mib_texture_lookup

Looks up a texture image.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

mib_texture_lookup2

Use this shader to look up a texture image. Unlike the mib_texture_lookup shader, you can set a Factor value that controls the strength of the texture effect.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

mib_texture_polkadot

A procedural texture to generate polkadots.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

mib_texture_polkasphere

A procedural texture to generate 3D polkadots.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

mib_texture_remap

Accepts a texture vertex and scales, rotates, translates, crops, and joins textures. The order of operations is transform first, then repeat, alternate, torus (wrapping), and finally min/max crop.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

mib_texture_rotate

An angle is used to rotate the surface orientation around the surface normal. An orthogonal vector pair is returned that, together with the normal which both are orthogonal to, define the rotated orientation. This is especially useful for anisotropic reflection.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

mib_texture_turbulence

Create a turbulent scalar pattern in a unit cube. One, two, or all three texture vector components may be computed in polar coordinates, causing spherical mapping.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

mib_texture_vector

Return a texture vector derived from orthographic projections of the 3D point in space (XY, XZ, YZ), non-orthographic projections (spherical or cylindrical); or return a numbered texture vector from the texture vector list. Optionally, this shader can base its calculations on object, camera, world, or screen space.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

mib_texture_wave

Create cosine waves in U, V, and W directions, each with a programmable amplitude. (Frequency and offset can be controlled using a texture remapping base shader.) The result is a grayscale color, R=G=B=A, that can be remapped using a color map base shader.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

Environments

These are shaders that catch rays leaving the scene, similar to Environment textures.

These shaders return colors from color textures that have been mapped to finite or infinite distances. Use them for background or foreground plates. Environments must be used for environment shaders; overlays must be used for lens shaders; and textures must be used for texture or material shaders on a plane or other objects in the scene.

They can be used either globally or on an object-specific basis.

mib_lookup_background

Use this to insert background plates, like image planes.

Place the background plate in the background of the scene so that it matches the size of your image resolution. Depending on which shader you're using, you can do the following:

- Environment shaders can place the background plate at infinity.
- Lens shaders can place the plate in front of the entire scene by evaluating the background shader first then casting an eye ray only if the returned alpha is less than 1, and blending the results.

- Material shaders on an XY-axis-aligned-plane in the scene insert the plate at the Z coordinate of the plane if they first evaluate the background shader, then cast a transparency ray only if the returned alpha is less than 1, and blend the results.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

mib_lookup_cube1

A cube mapping with one image on all six planes.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

mib_lookup_cube6

A cube mapping with six images, one for each plane.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

mib_lookup_cylindrical

A cylindrical mapping that uses one image.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

mib_lookup_spherical

A spherical mapping that uses one image.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

Lights

Light shaders specify the amount of light that a light source contributes to a particular surface point, taking into account the intensity and directional properties of the light source.

When a light shader is connected to a native Maya light source, all the settings on the Maya light source (color, intensity, shadows, and so on) are ignored, with the exception of the position and orientation (the light shader takes settings from the native Maya light source).

mia_physicalsun

New

Use this shader to produce a physically accurate rendering of daylight. Use this shader in conjunction with the mia_physicalsky shader. For more information, see "Simulating the sun and sky" on page 84 in the *Lighting* guide.

For a full description of this shader, see the *mental ray for Maya architectural shaders* document.

mib_blackbody

The blackbody light utility shader.

mib_cie_d

The CIE D Illuminant light utility shader.

mib_light_infinite

Infinite (directional) lights cast parallel rays in the light direction. The origin is infinitely far away (and left unspecified), and there is no decay.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

mib_light_photometric

Uses a vendor-supplied light profiles (IES or Eulumdat) This supplies a full description of the physical behavior of the specific light.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

mib_light_point

A point light shader emitting light uniformly in all directions.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

mib_light_spot

The spot light is similar to the point light, except that it also supports angle attenuation based on the light direction. It takes the light direction and the spread from the light definition.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

physical_light

This models physically correct light sources. The light energy decreases quadratically.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

Photon Emitter shaders

These shaders (not supplied with Maya) can be used to specify the intensity and directional distributions of the photons emitted by a light source

Light Maps

Use these shaders to bake surface shading effects to image texture files on disk.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

mib_lightmap_sample

The lightmap illumination sampling shader is a simple color shader that samples the surface light influx density. It gathers direct illumination and (optionally) indirect illumination. Assign it not to a material, but instead to the input parameter of the mib_lightmap_write node.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

mib_lightmap_write

This is the main lightmap shader. It gathers geometric information and texture coordinates on the triangle vertices and then writes a triangular region of texture for each triangle. For each pixel of the texture that the triangle covers, a sampling function is called and the results are written to the shader. The lightmap shader is attached to the appropriate input in the Shading Group.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

Lenses

These shaders determine how rays of light bend as they leave the camera, and can be used to simulate various lens effects such as depth of field.

Currently the UI only supports connection of a single lens shader to the camera. In general, the mental ray render core supports a series of lens shaders that are executed in succession.

mia_exposure_simple

New

Use this shader to convert an image from a high range to a standard one to accommodate the limitations of display devices. This shader adds an interpolation curve with a "knee" to "squash" overbrights into a more manageable range. Apply this shader either as a lens shader or as an output shader. The former is encouraged and tone-maps the image "on the fly" as it is being rendered. The latter tone maps the image as a post process.

For a full description of this shader, see the *mental ray for Maya architectural shaders* document.

mia_physicalsky

New

Use this shader to produce a physically accurate rendering of daylight. Use this shader in conjunction with the mia_physicalsun shader. For more information, see "Simulating the sun and sky" on page 84 in the *Lighting* guide.

For a full description of this shader, see the *mental ray for Maya architectural shaders* document.

Mib_lens_clamp

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

Mib_lens_stencil

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

Oversampling_lens

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

physical_lens_dof

Simulates depth of field by casting multiple eye rays into the scene so that an object at the focal distance is sharp and in focus, while objects at other distances are blurred.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

Output shaders

Output shaders, which are used to postprocess rendered images, are connected to the camera using the Output Shader attribute in the mental ray section of the camera's Attribute Editor.

The Framebuffers attributes in that section (color, alpha, depth, and so on) control which image channels are passed to the shader and in what format. For example, a 2D blur output shader might require 8-bit color, floating-point alpha, and motion vectors.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

Geometry shaders

These shaders can be used to introduce new pieces of geometry into the scene at render time.

Geometry shaders are connected to transform nodes, which are used to determine the position and orientation of the geometry.

Note	Even if this option is enabled (in the transform node's Attribute Editor, ... Enable Geometry Shader checkbox), you don't see anything in the Scene Views; you see the geometry only when you render.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

mib_geo_add_uv_texsurf

This shader returns a copy of the input object, which must be of freeform-surface type. It loops over all faces and adds a Bézier texture surface of degree 1 to each face as the last texture surface. The parameters and control points of the texture surfaces so that the texture coordinates of the triangle vertices are the uv coordinates of the triangle vertex positions.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

mib_geo_cone

This is a sample geometry shader to be used with mib_geo_add_uv_texsurf.

It generates a polygonal cone centered on the Z axis with the apex at Z=0 and the base at Z= -1. The cone has a radius of 1 at the bottom and a height of 1. The cone bottom disc is subdivided into u_subdiv subdivisions, the cone side in v_subdiv subdivisions in the Z axis direction.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

mib_geo_cube

This is a sample geometry shader to be used with mib_geo_add_uv_texsurf.

It generates an axis-aligned unit cube with volume 1 centered on the origin.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

mib_geo_cylinder

This is a sample geometry shader to be used with mib_geo_add_uv_texsurf.

It generates a polygonal cylinder centered on the Z axis with the bottom at Z=-1 and the top at Z=0. The cylinder has a radius of 1 and a height of 1. The two cylinder discs are subdivided in u_subdiv subdivisions, the sides in v_subdiv subdivisions in the Z axis direction.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

mib_geo_instance

This constructs an instance of one of a geometry shader that translates, scales, and rotates the geometry, and returns a group with the instance of the source geometry as its only member. If the result was nonzero because the base shader is part of a list, a new group is not created; instead the instance is added to the result group.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

mib_geo_instance_mlist

Same as mib_geo_instance, but accepts a material array, which is converted into a material list in the new instance if the array has more than one member. Material lists are useful if the instanced object is tagged, meaning its polygons or surfaces carry integers that index into the material array.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

mib_geo_sphere

Generates a polygonal sphere with a given number of U and V subdivisions, centered on the origin. The sphere is subdivided with v_subdiv subdivisions in the Z axis (longitude) and u_subdiv subdivisions in the XY plane (latitude).

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

mib_geo_square

Generates a square with area 1 centered on the origin, with the normal pointing up the positive Z axis.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

mib_geo_torus

Generates a polygonal torus lying in the XY plane, centered at the origin. The torus is defined by two circles: the smaller one revolves around the center of the larger circle.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

Contour store

Contour store shaders decide what kind of information to store at an image sample location. This information allows the contour contrast shader to decide whether two samples are different enough to place a contour line between them.

contour_store_function

This shader returns the intersection point, normal, material tag, object label (tag), triangle index, color, and the refraction and reflection level.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

contour_store_function_simple

This contour store function only stores the material tag. It can be used for very fast contour computations if only the outlines of objects need to have simple contours.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

Contour contrast

contour_contrast_function_levels

This lets you to modulate a threshold within a sample range. It draws a contour between two samples, if their sample values differ more than the specified threshold.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

contour_contrast_function_simple

This uses a default contrast definition.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

Contour shader

These shaders can be used to generate cartoon-like renderings. After the contour contrast shaders decide where contours should be drawn, contour shaders decide on the contour color and width (and optionally motion, normal, material tag, and label).

contour_shader_combi

This is a combination of the depthfade, layerthinner, and widthfromlight contour shaders.

The width of the contour fades into the background (from near_width to far_width), and the color fades from near_color to far_color. The contour width and color changes with a ramp function between distances near_z and far_z. For each layer the ray has passed through, a factor is multiplied onto the width. If no factor is specified, the width will not depend on the layer. If a light source is specified, the width also depends on the surface normal relative to the light source direction.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

contour_shader_curvature

This shader draws contours whose width depends on the curvature (the difference in surface orientation).

If two normals are in nearly opposite directions, there is a contour of width close to max_width between them. When the angle between them decreases, the width of the contour decreases down to nearly min_width. (The width will never reach min_width completely, since the contour contrast function will not create any contours where the surface curvature is less than ndelta degrees, and ndelta cannot be set to zero without getting contours in the interior of all objects.)

At the edge of an object, where the depth difference is large, the maximum contour width is used. The minimum width would theoretically occur at 0 degrees and the maximum width at 180 degrees.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

contour_shader_depthfade

Contours are drawn whose color and width are linearly interpolated between two values as specified with the near and far parameter sets.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

contour_shader_factorcolor

This shader draws a contour whose color matches the color of the object being contoured, only with a different brightness (usually much darker).

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

contour_shader_framefade

This shader draws contours with a color and width that depends linearly on the frame number. Two frame numbers, colors, and widths are specified. If the frame number is less than the first frame number, the first color and width is used. If the frame number is higher than the last frame number, the last color and width are used. If the frame number is in between, a linear interpolation of the two colors and widths are used.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

contour_shader_layerthinner

With this contour shader, the width of a contour will change depending on how many levels of materials are on top of it. If the material is on top, its contour will be of a width specified by a parameter. For each material on top of it, its width will decrease by a factor that is also controllable with a parameter.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

contour_shader_randomtransparency

Contours are drawn with a random transparency, based on the specified value.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

contour_shader_randomwidth

Contours are drawn with a random width, based on the specified value.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

contour_shader_simple

A simple contour of constant color and width is applied when contour_shader_simple is used.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

contour_shader_widthfromcolor

With the contour_shader_widthfromcolor contour shader, a material gets contours whose thickness depends on material color. The thickness depends on the maximum of the red, green, and blue color bands (the maximum is clamped to 1 if it is larger than 1). When the color is bright no contour is visible, and when the color gets darker the contour gets wide. The minimum width is used at bright colors and the maximum width is used at black.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

contour_shader__widthfromlight

Contours are drawn whose width depends on the angle between the surface normal and the direction to a light source. The thickness increases gradually from min_width when the surface is directly facing the light direction to max_width when the surface is facing exactly opposite the light direction.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

contour_shader_widthfromlightdir

This shader is a variation of the contour_shader__widthfromlight. It accepts a direction explicitly, instead of a light that implicitly provides the direction.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

Contour output

Contour output shaders are called after the regular image has been computed.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

contour_only

This generates a contour image with a given background color in the color frame buffer, discarding the rendered color image. See also Hide Source in the mental ray tab in the Render Settings window.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

contour_ps

The contour output shader contour_ps creates PostScript code with black contours. The PostScript code can be written to a file with a separate output statement that specifies the file type ps. This shader does not touch the rendered color frame buffer.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

contour_composite

This layers contours on top of a given source.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

Sample Compositing

mib_dielectric

Another variation of refraction, with the addition of specularity (Snell's law). This shader does only the refraction part of a dielectric material; highlights are left to other illumination nodes.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

mib_opacity

Casts a transparency ray of a given intensity and merges the result with an input color.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

mib-reflect

Casts a reflection ray of a given color and merges the result with an input color. Use it to add a reflection effect to a base shader that provides illumination, possibly in conjunction with refractions or transparency added by other base shaders. If no reflection ray can be cast (because the trace depth has been exceeded, or the reflection ray caused a shader to be called that failed, or the notrace parameter is set), sample the environment if there is one.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

mib_refract

Casts a refraction ray of a given color with an index of refraction and merges the result with an input color. The indices of refraction can be computed with another base shader, such as mib_refraction_index, which is also stored back into the appropriate state variables. Use this to add a refraction effect to a base shader that provides illumination.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

mib_refraction_index

Decide whether the ray is entering or leaving the object it has hit, based on a scan of parent rays (not based on the normal vector). The index of refraction ratio (outgoing divided by incoming) is returned. As a side effect, both incoming and outgoing indices of refraction are stored in the state (ior_in and ior, respectively), and the current volume shader becomes the refraction volume if the ray is entering.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

mib_transparency

Casts a transparency ray of a given color and merges the result with an input color.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

mib_twosided

Choose one or the other input color, depending on which side of the geometry was hit. This is commonly used as a multiplexing material shader, with two other material shaders assigned to the front and back parameters.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

Data conversion

mib_color_alpha

Convert a color to RGBA grayscale, either by extracting the alpha component, by averaging RGB, or by weighting RGB according to a physiological color model that emphasizes green and deemphasizes red. The resulting grayscale value can also be used as a scalar. The returned R, G, B, and A components all have the same value.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

mib_color_average

See "mib_color_alpha" on page 447.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

mib_color_intensity

See "mib_color_alpha" on page 447.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

mib_color_interpolate

Given a scalar or a color, perform a lookup and interpolation of a multicolor map. The map is a set (not array) of up to 8 colors. The actual number of colors is specified by a parameter.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

mib_color_mix

Accepts a base color and up to 8 inputs (the exact number is determined by a parameter), each of which consists of an input color, a weight scalar, and a mode. The inputs are evaluated in sequence, each operating on the result of the previous one (the first begins with the base color, which defaults to transparent black).

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

mib_color_spread

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

Miscellaneous

mentalrayPhenomenon

When you create and load Phenomenon, the nodes appear here. See "Phenomena" on page 170.

mental ray mia_material shader attributes

New

Presets

This drop-down list provides many useful presets for materials commonly used in architectural and product design renderings. This list of presets include: Ceramic, Floor, Frosted Glass, Glass Pane, Glazed Cermaic, Stone, Thick Glass, and Wood.

You can select an item from this list to load the preset values for the material that you choose. You can use these settings as-is, or as a starting points for tweaking.

mia_material shader attributes

See the mental ray for Maya architectural shaders guide for more information regarding the mia_material shader attributes. For a list of mia_material attributes and their corresponding parameter in mental ray, refer to the following table.

Section in mia_material Attribute Editor	Option in mia_material Attribute Editor	Corresponding mental ray parameter
Diffuse Shading	Diffuse Weight	diffuse_weight
	Diffuse	diffuse
	Diffuse Roughness	diffuse_roughness
Reflectivity	Reflectivity	reflectivity
	Reflection Color	refl_color
	Reflection Gloss	refl_gloss

Section in mia_material Attribute Editor	Option in mia_material Attribute Editor	Corresponding mental ray parameter
	Reflection Gloss Samples	refl_samples
	Highlight vs Refl Balance	hl_vs_refl_balance
	Interpolate Reflections	refl_interpolate
	Vis Area Light Refl Only	no_visible_area_hl
	Skip Inside Reflections	skip_inside_refl
	Highlight Only	refl_hl_only
	Reflection Is Metal	refl_is_metal
	Single Env Sample	single_env_sample
	Reflection Falloff	refl_falloff_on
	Falloff Distance	refl_falloff_dist
	Reflection Falloff Color	refl_falloff_color_on
	Falloff Color	refl_falloff_color
	Reflection Depth	refl_depth
	Reflection Cutoff	refl_cutoff
Refraction	Transparency	transparency
	Refraction Index	refr_ior
	Refraction Color	refr_color
	Refraction Gloss	refr_gloss
	Refraction Gloss Samples	refr_gloss_samples
	Interpolate Refractions	refr_interpolate
	Translucency	refr_translucency
	Translucency Color	refr_trans_color
	Translucency Weight	refr_trans_weight

Section in mia_material Attribute Editor	Option in mia_material Attribute Editor	Corresponding mental ray parameter
	Cutout Opacity	cutout_opacity
	Refractive Caustics	do_refractive_caustics
	Backface Cull	backface_cull
	Thin Walled	thin_walled
	Propogate Alpha	propagate_alpha
	Refraction Falloff	refr_falloff_on
	Falloff Distance	refr_falloff_dist
	Refraction Falloff Color	refr_falloff_color_on
	Falloff Color	refr_falloff_color
	Refraction Depth	refr_depth
	Refraction Cutoff	refr_cutoff
Interpolation	Grid Density	intr_grid_density
	Reflection Samples	ntr_refl_samples
	Detail Distance	intr_refl_ddist_on
	Reflection Detail Distance	intr_refl_ddist
	Refraction Samples	refr_samples
Anisotropy	Anisotropy	anisotropy
	Anisotropy Rotation	anisotropy_rotation
	Anisotropy Channel	anisotropy_channel
Bump	Texture	bump
	No Diffuse Bump	no_diffuse_bump
BRDF	Conserve Energy	brdf_conserve_energy
	Fresnel	brdf_fresnel

Section in mia_material Attribute Editor	Option in mia_material Attribute Editor	Corresponding mental ray parameter
	Refl Perpendicular to View	brdf_0_degree_refl
	Refl Facing View	brdf_90_degree_refl
	BRDF Curve	brdf_curve
Ambient Occlusion	Ambient Occlusion	ao_on
	Details	ao_do_details
	Samples	ao_samples
	Distance	ao_distance
	Dark	ao_dark
	Ambient	ao_ambient
Final Gather	Indirect Multiplier	indirect_multiplier
	Final Gather Quality	fg_quality
	FG Quality W	fg_quality_w
Light Linking	Mode	mode
lights	lights	lights
Additional	Additional Color	additional_color

Feature-based displacement map

Feature-based displacement map attributes

- ”Connect a displacement map” on page 117.
- ”Adjust displacement sampling rates” on page 118.

Feature Displacement
Turn on (default) Feature-based Displacement.

Note	We do not recommend that you turn off Feature-based displacement to use non-feature-based displacement.

Initial Sample Rate

This rate is used to check the texture values to determine the difference between displacement heights and where to introduce new vertices. It defines a regular sampling grid in each original tessellation triangle. For example, with the default value of 6, the sample grid is 6x6.

Try to keep this sample rate to a reasonable value since it does take longer to render the higher the value.

For each tessellation triangle, notice how much texture height variation is in the triangle and estimate how many initial samples are required to include these features when displacement mapping. Consider the following:

- If the original triangle is large and the feature in the triangle is fine, then the Initial Sample Rate has to be large to include the fine features.
- If the original triangle is small and the features are sparse, the Initial Sample Rate does not have to be very large. The default of 6 may be enough.

Extra Sample Rate

This rate is used to take extra samples to refine the new vertices introduced during displacement mapping. Maya adjusts the vertices to align with the displacement.

For each tessellation triangle, notice how sharp the features are and how many curvy features there are. The sharper the features, the higher the Extra Sample Rate needs to be; adjust accordingly

Always try to set this value at 0 first if the result looks too jagged, then increase the value to get the results you need. The default value is 5. A value of 20 is usually enough.

In the following examples, the displaced surface on the left only needs an Extra Sample Rate value of 0, but the surface on the right needs an Extra Sample Rate of 5.



Image by
Christine Beaumont

Image by
Matt Dougan



Texture Threshold

This value is used to eliminate vertices that do not significantly contribute to the displacement. This is a threshold of the percentage of the maximum height variation. Any vertex where the variation is smaller than this value is not considered. The default value is 0.

Note It is recommended that you pre-process the texture so that it contains as little noise as possible and leave this value at the default of 0. Consider the following:

- If render times are high, you can increase default value slightly.
- If you have black and white (embossing), the default setting of 0 is optimal.
- If you have smooth displacement, like a bulge, specify small values (as close to 0 as possible).

Normal Threshold

Determine the angle threshold of the normal difference between two adjacent triangles (the angular value is in degrees). If the normal difference is higher than the threshold, the edge between these two triangles is recognized as a sharp edge. If lower, the normals are averaged which produces smooth edges. The default value is 30 degrees.

Note It is recommended that you leave this value at the default of 30.

Bounding Box Scale

Warning

Be careful if you have an animation that changes the relationship between the displacement and the size of the surface being displaced. Choose the most extremely-displaced frame to perform the Calculate Bounding Box Scale operation. Alternatively, animate the value manually.

Determines the bounding box scale for a displacement map and helps to compute the bounding box scale automatically by tessellating the object.

Bounding Box Scale lets you estimate the size of a displaced object's bounding box. It is in world space because the displacement is applied to vertices in world space. Based on the bounding box scale, Maya calculates the new bounding box for the displacement-mapped object.

When you scale the bounding box, make sure it is not too small or the displacement may look cut-off or look as though it has holes. The default bounding box scale (1.5 in world space) should be adequate in most situations; however, if you want large-scale displacement, increase the bounding box scale significantly. If you do not increase the size enough, artifacts result in the rendered image, but if the estimate is too large, Maya may use more memory to render the object.

Image Planes

Image plane

The Image Plane's Attribute Editor automatically disables the attributes for procedural textures when image files are used, and disables the attributes for image planes when procedural textures are used.

Display

Looking through camera — The image plane only appears in the camera view in which the image plane is connected.

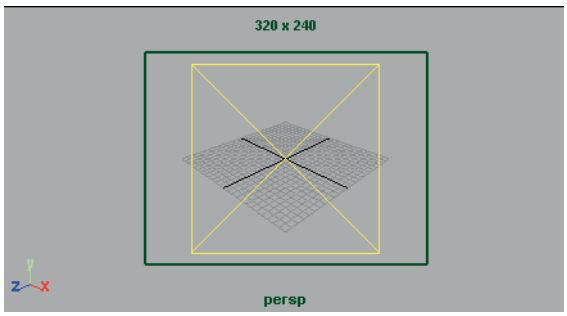
In all views — The image plane appears in all views. Display is set to In all views by default.

Display Mode

Controls how the image plane appears in views and in the rendered image. The default setting is RGBA.

None — No display in views or rendered image.

Outline — A rectangle with diagonal lines in views; full 24 bit color image and transparency (alpha) in rendered image.



RGB — Full 24 bit color image in views; full 24 bit color image and transparency (alpha) in rendered image.

RGBA — Full 24 bit color image and transparency (alpha) in views and rendered image. (If the image file does not contain an alpha channel, set Display Mode to RGB instead of RGBA.)



Luminance Grayscale image in views; gray-scale image and transparency (alpha) in rendered image.



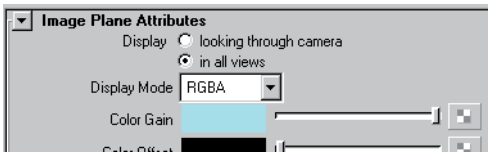
Alpha Transparency (alpha) in views and rendered image.

Color Gain

A scaling factor applied to all colors in the image plane. Maya multiplies all colors in the image plane by the Color Gain color. For example, you can color correct an image plane that appears too green by setting the Color Gain color to a shade of blue. The default color is white (no effect).



Click the color swatch next to Color Gain to open the Color Chooser and select a color.





Result with new Color Gain color.

Color Offset

An offset factor applied to all colors in the image plane. Maya adds the Color Offset color to all colors in the image plane. For example, you can brighten an image plane that appears too dark by dragging the slider to set the Color Offset color to a shade of grey. The default color is black (no effect).

Alpha Gain

A scaling factor applied to the alpha channel (transparency) of the image plane. Maya multiplies all alpha values in the image plane by the Alpha Gain value. The slider range is 0 to 1, but you can type in higher values. The default value is 1 (no effect).

Image Plane

Attached to Camera — Maya attaches the image plane to the camera. When you move the camera, the image plane also moves. Use this setting when you want to use the image plane as a reference for animating objects in the scene (such as motion matching or rotoscoping), or if you plan to render the image plane as a background.

Fixed — Maya fixes the image plane in space. When you move the camera, the image plane does not move. Use this setting when you want to use the image plane as a reference for modeling objects in the scene.

The default setting is Attached to Camera for perspective cameras, and Fixed for orthographic cameras.

If set to Fixed, you can adjust the image plane using the "Placement Extras" attributes.

Type

The default setting is Image File. Select from the following:

Image File If set to Image File, the image plane uses the image file assigned to Image Name.

Texture If set to Texture, the image plane uses the texture assigned to Texture.

Image Name

The path and name of the image file or movie file that the image plane uses when Type is Image File. Image files can be in any Maya-supported image file format.

Use Image Sequence

If off (default), the image plane used is the single image file indicated by Image Name (the file name and extension).

If on, the image loaded corresponds to an image from the sequence selected, determined by the Image Number.

Image Number

If Use Image Sequence is on, the default expression of "=frame" is used to synchronize the image sequence with the Timeline.

In other words, at frame 1 the image with a numeric value of 1 in it will be loaded. At frame 24, the image with a numeric value of 24 in it will be loaded.

By modifying the default expression (or removing it and setting keys) for Image Number, you specify alternate timeline to image sequence number relations. For example, setting a key frame of the last image at the beginning of the timeline and the first image at the end of the timeline will result in reversing the sequence.

Frame Offset

If Use Image Sequence is on, the default Frame Offset is set to 0, which means that the image sequence numeric value corresponds exactly to the timeline frame number. If an offset between these values is needed, enter the desired offset in frames. For example, if the image sequence numeric value starts at 100 but the animation starts at frame 1, enter a value of 100 to compensate. Negative offset values are also supported.

Texture

The texture the image plane uses when Type is Texture. A texture assigned to an image plane does not display in the views.

Placement

Use the Placement attributes to position an image plane relative to the camera.

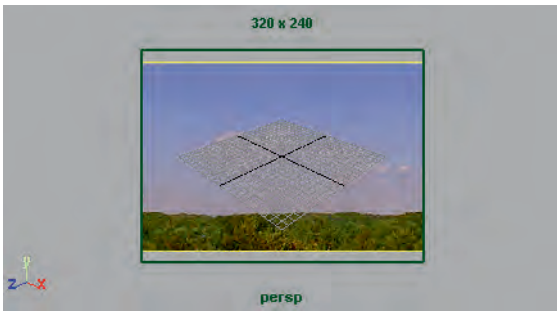
Fit

Controls the size of the image plane relative to the film gate and resolution gate. You can choose a Fit option from the drop-down list. Best is the default Fit.

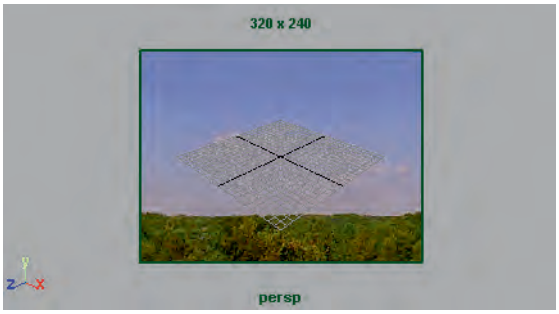
See also "Turn scene view guidelines on or off" on page 34 in the *Rendering* guide.

Fit is not available if Image Plane is Fixed.

Fill By default, or if you select Fit to Film Gate, the image plane fills the film gate.

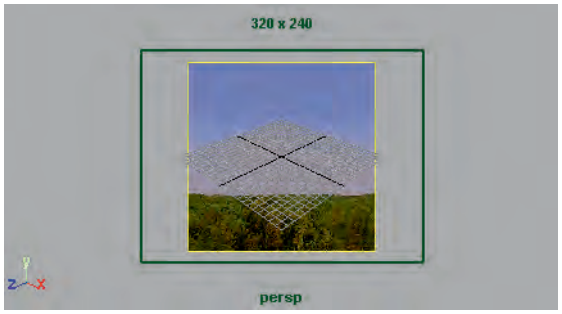


If you select Fit to Resolution Gate, the image plane fills the resolution gate.

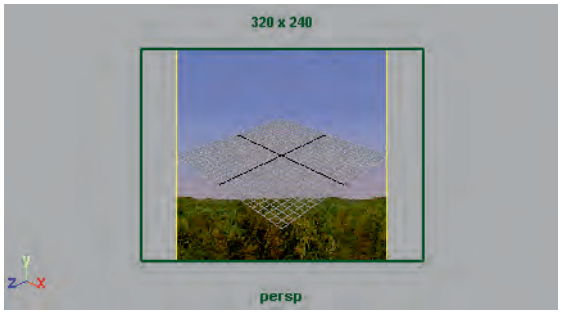


Maya maintains the aspect ratio of the image on the image plane. If the aspect ratios of the image and the film gate (or resolution gate) are different, the image extends beyond the film gate (or resolution gate) and is cropped.

Best By default, or if you select Fit to Film Gate, the image plane fits horizontally or vertically within the film gate.



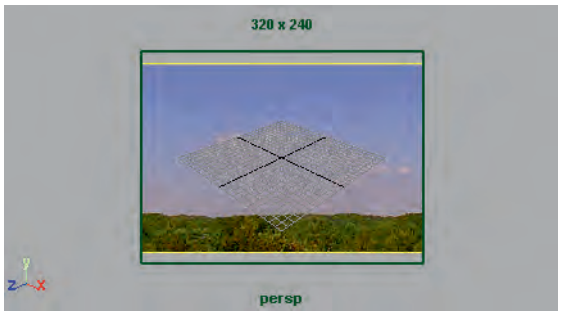
If you select Fit to Resolution Gate, the image plane fits horizontally or vertically within the resolution gate.



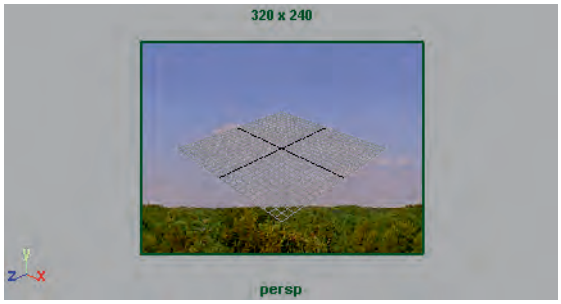
The aspect ratio of the image on the image plane is maintained. If the aspect ratios of the image and the film gate (or resolution gate) are different, the film gate (or resolution gate) extends beyond the edge of the image.

Horizontal

By default, or if you select Fit to Film Gate, the image plane fits horizontally within the film gate.

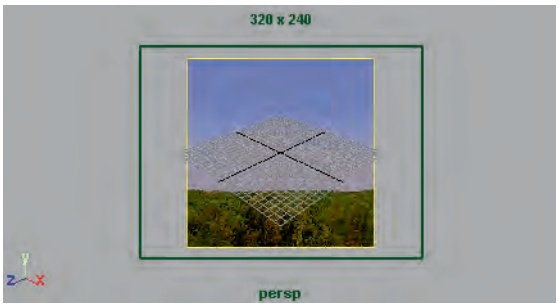


If you select Fit to Resolution Gate, the image plane fits horizontally within the resolution gate.

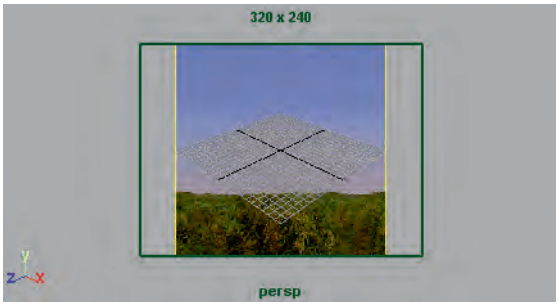


The aspect ratio of the image on the image plane is maintained. If the aspect ratios of the image and the film gate (or resolution gate) are different, the image extends vertically beyond the film gate (or resolution gate) and can be cropped.

Vertical By default, or if you select Fit to Film Gate, the image plane fits vertically within the film gate.



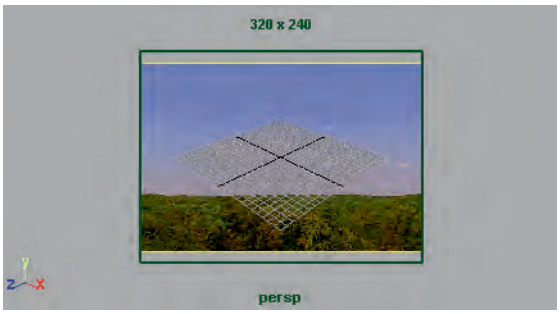
If you select Fit to Resolution Gate, the image plane fits vertically within the resolution gate.



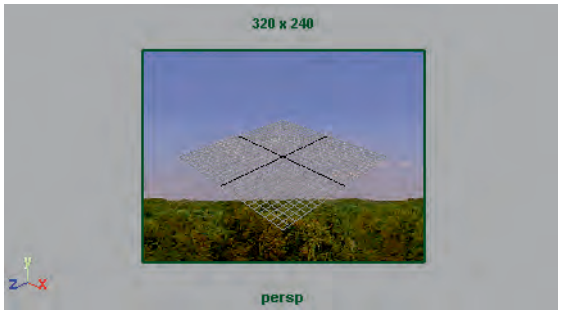
The aspect ratio of the image on the image plane is maintained. If the aspect ratios of the image and the film gate (or resolution gate) are different, the image extends horizontally beyond the film gate (or resolution gate) and can be cropped.

To Size

By default, or if you select Fit to Film Gate, the image plane fills the film gate.



If you select Fit to Resolution Gate, the image plane fills the resolution gate.



The aspect ratio of the image on the image plane is *not* maintained. If the aspect ratios of the image and the film gate (or resolution gate) are different, the image stretches to fit within the film gate (or resolution gate).

Fit to Resolution Gate

Scales the image plane so that it is the same size as the resolution gate of the camera. Fit to Resolution Gate has no effect if Image Plane is Fixed.

See also "Turn scene view guidelines on or off" on page 34 in the *Rendering* guide.

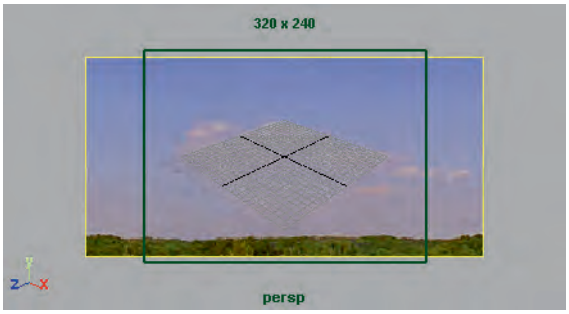
Fit to Film Gate

Scales the image plane so that it is the same size as the film gate of the camera. Fit to Film Gate has no effect if Image Plane is Fixed.

See also "Turn scene view guidelines on or off" on page 34 in the *Rendering* guide.

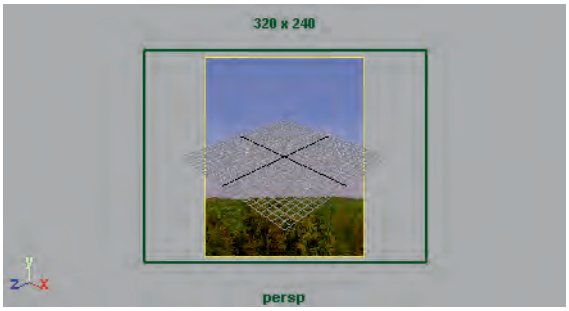
Size

The height and width of the image plane, measured in inches. If the image plane is Fit to Film Gate, the Size of the image plane is the same as the Camera Aperture. Size is not available if Image Plane is Fixed.



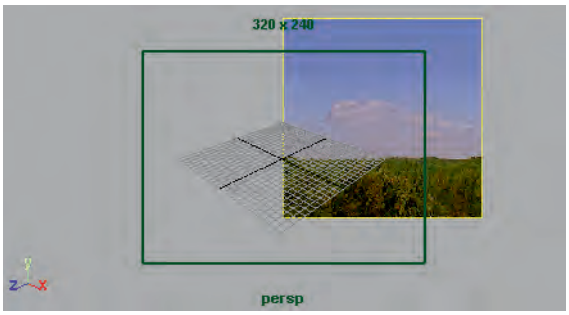
Squeeze Correction

Scales the image plane horizontally when Fit is To Size. If the Pixel Aspect Ratio for the scene is different than the pixel aspect ratio of the image plane's image file, adjust the Squeeze Correction attribute to compensate for any distortion. The default value is 0.



Offset

Offsets the image plane horizontally and vertically relative to the film gate. Offset is not available if Image Plane is Fixed. Offset is measured in millimeters. The default values are both 0.



Depth

The distance of the image plane from the camera, measured in the scene's linear working unit. Depth is not available if Image Plane is Fixed.

Placement Extras

The Placement Extras attributes control which portion of an image file is visible on the image plane. If Image Plane is Fixed, the Placement Extras attributes also control the position and size of the image plane.

Coverage X, Coverage Y

The number of horizontal and vertical pixels of the image file displayed on the image plane. The default values for Coverage X and Coverage Y are the horizontal and vertical resolution of the image file. By decreasing these values, you can limit the portion of the image file that is displayed.

Coverage Origin X, Coverage Origin Y

The horizontal and vertical value of the pixel in the image file displayed in the bottom left corner of the image plane. By changing the Coverage Origin X and Coverage Origin Y values, you can scale and offset the image file on the image plane. The default values are both 0.

The following diagram shows what happens to the image plane placement when you adjust Coverage attributes:



Default settings.



Coverage X and Y set to 150 and Coverage Origin X and Y set to 10.

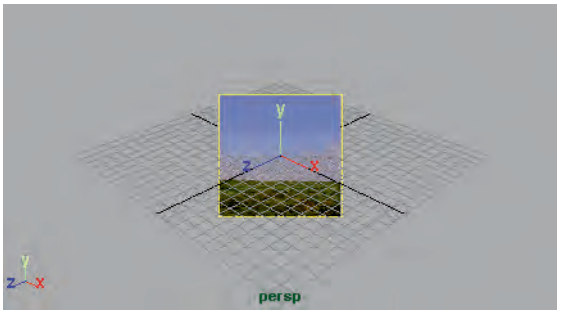
Center

The position of the center of the image plane (measured in the scene's linear working unit). Center is not available if Image Plane is Attached to Camera.

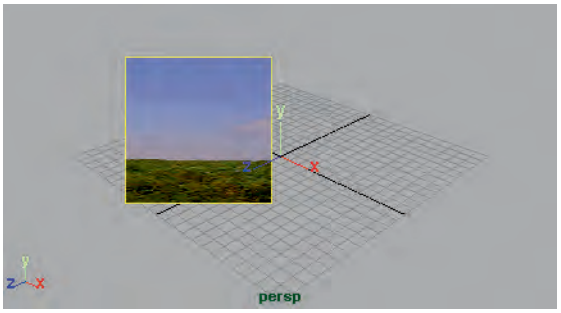
Width, Height

The width and height of the image plane (measured in the scene's linear working unit). Width and Height are not available if Image Plane is Attached to Camera.

The following diagramS shows what happens to the image plane placement when you adjust center, width, and height attributes:



Default settings.



Leave all default settings but change Y and Z to 5.0 and 8.0.

Depth

Use Depth Map Check this option to enable z-depth support of your image plane.

Composite Depth Indicates that the color information should be composited with the depth information. If this option is off, then no color information is written and only the depth information is included. This is useful if you want to post-composite your result in another software package. A preview of the result will be drawn in the viewport.

Separate Depth If on, a separate file is used for assigning the depth information.

Depth File The image file that contains the depth information. If no file is specified in this option, Maya will search for the depth information encoded in the main image file.

Depth Oversample If on, the depth buffer is oversampled to assign pixel depth values during software rendering. Oversampling helps to reduce aliasing effects that may be introduced using the depth buffer. Oversampling is only used with the software renderer and produces the most optimal results if the depth buffer size is an integral size larger than the image size and the image size is identical to the software render resolutions.

Depth Bias	If on, the z-depth information is offset from the center of the view frustum. The unit for this value is centimeters.
Depth Scale	If on, scales the z-depth information at the center of the view frustum.

Bake set nodes

Texture Bake Set

For more information on bake sets, see "Bake sets" on page 148.

Texture bake set attributes

Color Mode

Determines the baking mode for the scene. Select one of the following:

Light and Color	Bakes light and color information.
Only Light	Bakes only lighting information.
Only Global Illumination	Bakes only global illumination information
Occlusion	Bakes occlusion information.
Custom Shader	Bakes the specified custom shading network into the bake set.

Occlusion Rays

Determines the number of occlusion rays to trace per sample point. Increasing the number of occlusion rays improves quality, but reduces performance speed. The default is 64.

Occlusion Falloff

Determines the maximum length of an occlusion ray. Rays longer than this value are not considered for occlusion.

For texture bake sets, if Final Gather is not used, occlusion is computed for all sample points. Although this takes time, the result is very sharp light maps. If Final Gather is used, and the final gather quality is greater than 0, the occlusion is pre-baked into a final gather map. This final gather map can then be interpolated during rendering providing quick results at a reasonable quality.

Custom Shader

Use the new Custom Shader attribute to connect a custom shading network to your bake set.

To use this attribute, Color Mode must be set to Custom Shader, then you can map the Custom Shader field to the shading network.

Normal Direction

Use the Normal Direction drop-down list to set the direction of the baked object's resulting normals. Select from Face Camera (towards the camera), Surface Front (outwards from the object surface), and Surface Back (inwards from the object surface).

Orthogonal Reflection

This option is on by default. When turned on, the Orthogonal Reflection option causes all reflection rays to be orthogonal to the surface being baked. They are no longer true reflection rays, pointing instead parallel to the surface normal vectors, but the resulting baked texture or vertex colors are meaningful when viewed later from any direction. This option should be turned on if the textures or vertex colors generated are to be used as textures in a game engine.

Turn this option off if you are baking in order to accelerate software rendering and the reflections are only viewed from the baked position. However, in this case, the textures or vertex colors generated are not for use as textures in a game engine.

Filename Prefix

Any bitmaps generated by this bake set are prefixed with what is typed in this box. When Bake to One Map is checked, what you type in this box becomes the filename.

x resolution, y resolution

The horizontal and vertical resolution of the image file, measured in pixels. The slider range is 1 to 512. The default value is 256.

File format

Lets you choose a format in which to save the file texture. The default is IFF.

Bits per channel

Specifies the number of bits per channel to use in the output bitmap.

Number of Samples

Use this option to specify the number of samples (per pixel) that is used for anti-aliasing during baking. The default value is 1, and the maximum value is 4.

Bake to One Map

Any objects assigned to this bake set is baked to the map. (Make sure the object's UVs are not overlapped.)

Bake Alpha

Turn this on to bake the alpha channel (equivalent to Maya's Bake Transparency option) and then select an Alpha Mode.

Note	When you turn Bake Alpha on, the transparency connection is automatically made for you when you add a surface shader.

Alpha mode

When Bake Alpha is turned on, the Alpha Mode specifies how it's computed. Select one of the options, which include Pass Through (alpha as output from shading network) Surface Transparency, Luminance of Surface Color, and Coverage.

Note	The Pass Through option is mainly for custom shader usage within Maya. The returned baked color alpha component is retained and is not further affected by Maya's matte channel. Custom shaders usually set the fourth component of a mental ray color to provide the alpha channel.

Final Gather Quality

Determines the final gather precompute quality. When rendering from the camera, mental ray precomputes a final gather pass before actually rendering the scene. This precomputation pass is disabled by default for baking.

When this attribute is set to higher than zero, mental ray computes a number of final gather points before it bakes the lightmap. When this attribute is set to one, the resulting lightmap should be of approximately the same quality as a lightmap rendered from the camera. When this attribute is set higher than one, then the quality of the lightmap is improved as a denser map of final gather points is precomputed.

Do not use this option to tune final gather quality for baking. Final gather quality affects the number of points calculated at the precomputation phase of the final gather algorithm. By increasing the final gather quality, you are only creating more points during precomputation and possibly reducing the amount of interpolation or exterpolation required during rendering. Increasing the final gather quality does not affect the accuracy of the light calculated for each point or the filtering that is used on the data.

Instead, adjust the Scale in the Render Settings window. This attribute controls the accuracy of the light calculated for each final gather point. Adjust also the View (Radii in Pixel Size). This attribute controls how data is interpolated/extrapolated between final gather points.

Final Gather Reflect

Determines the reflectivity of an object when precomputing final gather points for light mapping. This simplifies the simulation of reflective objects whose texture maps include contributions from objects that surround them. For example, if the Final Gather Reflect value is set to 0.25, every fourth final gather point is precomputed on the object hit by the reflection ray.

UV range

Specifies whether to bake the area in UV space from [0,0] to [1,1], bake the entire UV space, or bake a manually specified space range.

U min, U max

Slider values specify how much to stretch the sampling range of U or V components. Maya stretches the sample region to fit the output image size within the [0,0] to [1,1] sampling range.

V min, V max

Minimum V and maximum V for baking.

Background Mode

When converting a file to a texture, occasionally some of the pixels along texture edges are missed. As a result parts of the geometry are not properly covered and the background color shows through. In the Background Mode drop-down list, there are three options for managing this situation.

Shader Default	A default color is applied to the background. The color may be a blend of the shader colors. This option is intended for compatibility with previous versions of Maya. This is the default.
Custom Color	Specify a color to apply to the background. For example, this can be useful if you want to import the file texture into image editing software and want a special key (color) to select the background for processing.
Extend Edge Color	Looks at the neighboring pixels' colors to determine the appropriate background color to extend the texture pattern at the edges. This option provides the best quality in some situations.

Background Color

Specifies the color to apply to the background when Custom Color is selected for the Background Mode.

Fill texture seams

If the selected UV space contains boundaries, these boundaries may appear as black stripes in renderings that use the baked textures. This occurs when the texture is sampled so close to a boundary that the filter picks up values (generally black) from outside the desired space.

This setting artificially extends the boundaries by a small amount to alleviate this problem. It is measured in texels (pixels of texture). Typically, the filter is only a few texels in diameter and can only reach as far as its radius into these boundary spaces, so a value of 1 or 2 is usually enough.

Override mesh UV set assignments

Activate this option to bake meshes as if they were in the specified UV set instead of the UV sets to which they are currently associated.

UV set name

The UV set to use for the meshes in this textureBakeSet.

Vertex Bake Set

For more information on bake sets, see ”Bake sets” on page 148.

Vertex bake set attributes

Color Mode

Determines the baking mode for the scene. Select one of the following:

Light and Color	Bakes light and color information.
Only Light	Bakes only lighting information.
Only Global Illumination	Bakes only global illumination information
Occlusion	Bakes occlusion information.
Custom Shader	Bakes the specified custom shading network into the bake set.

Occlusion Rays

Determines the number of occlusion rays to trace per sample point. Increasing the number of occlusion rays improves quality, but reduces performance speed. The default is 64.

Occlusion Falloff

Determines the maximum length of an occlusion ray. Rays longer than this value are not considered for occlusion.

Custom Shader

Use the new Custom Shader attribute to connect a custom shading network to your bake set.

To use this attribute, Color Mode must be set to Custom Shader, then you can map the Custom Shader field to the shading network.

Normal Direction

Use the Normal Direction drop-down list to set the direction of the baked object's resulting normals. Select from Face Camera (towards the camera), Surface Front (outwards from the object surface), and Surface Back (inwards from the object surface).

Orthogonal Reflection

This option is on by default. When turned on, the Orthogonal Reflection option causes all reflection rays to be orthogonal to the surface being baked. They are no longer true reflection rays, pointing instead parallel to the surface normal vectors, but the resulting baked texture or vertex colors are meaningful when viewed later from any direction. This option should be turned on if the textures or vertex colors generated are to be used as textures in a game engine.

Turn this option off if you are baking in order to accelerate software rendering and the reflections are only viewed from the baked position. However, in this case, the textures or vertex colors generated are not for use as textures in a game engine.

Create New Color Set / Color Set Name

Use this option to indicate the color set that you want to bake to.

Bake Alpha

Turn this option on to bake the alpha channel (equivalent to Maya's Bake Transparency option). When this option is turned on, you can set Min Alpha and Max Alpha values, and the Alpha Blending method. This attribute is off by default.

Bake Color

Turn this attribute off when you do not want to bake the color channel. When this option is on, you can set Min Color and Max Color values, and the Color Blending method. This attribute is on by default.

Scale Rgba

Scale vertex colors by the specified value.

Clamp Min, Clamp Max

Turn on these attributes to clamp the minimum and maximum color and alpha values so that the values are forced to be within the set range.

Min Alpha

The lower clamp limit for the alpha channel.

Max Alpha

The upper clamp limit for the alpha channel.

Min Color

The lower limit to which to clamp vertex color.

Max Color

The upper limit to which to clamp vertex colors.

Color Blending

Merges existing vertex colors with the ones just baked, if any. Select a merge method from the Color Blending drop-down list.

Alpha Blending

Merges existing vertex alphas with the ones just baked, if any. Select a merge method from the Alpha Blending drop-down list.

Vertex Color Filtering

Filter Size

If final gathering is baked to vertices and the scene contains high frequency information, discontinuities in the color channel may become visible. This artifact becomes especially apparent if low final gather quality settings are used. Filtering baked vertex colors yields the desired smooth look.

Provide a small positive filter size as argument to this parameter (it is multiplied by the object's bounding box size to obtain the absolute size). Set the Filter Size value to -1 to turn filtering off. Set the value to 0 or larger to turn it on.

Start with values in the 0.1 range as this value is multiplied by the object’s bounding box size to obtain the absolute size. This process also allows smaller values to be used for the Accuracy attribute in the Render Settings Window (mental ray tab > Final Gathering section) for faster performance although accuracy of results may need to be taken into account.

Lower final gather quality settings require larger filter sizes to get a smooth look and renders are less accurate. In general, the final gather quality should be raised as long as rendering times are acceptable; then the filter size should be increased until the desired smooth look is obtained. A tiny filter size may suffice; it enforces that baked colors are shared at vertices which have identical positions and normals.

Filter Normal Tolerance

The filter normal tolerance in degrees (0 to 180).

This lets you adjust the angular tolerance for smoothing value across faces.

Vertices whose angular separation is greater than the entered value are not taken into consideration for filtering so that crisp transitions are maintained across hard edges, and undesired color bleed doesn’t occur.

After adjusting this option, repeat the prelight operation to test. When a fairly smooth result is obtained, use the Filter Size to adjust further.

Use Face Normals

Use this option when you want to specify the use of face normals for baking instead of interpolated vertex normals (the default used for rendering). This option is off by default, and was previously found in the mental ray Baking Options (Batch Bake) dialog box.

Maya Render Nodes

General Utilities

About General Utilities

Maya provides general utilities in Create Render Node to enable you to add extra effects to your scene. For example, you can use the general utilities to sample light or surface property information, convert a 2D or 3D texture to bump maps, or multiple/divide or add/subtract input attributes. The following is a list of general utilities available in Maya:

- "Array Mapper" on page 473
- "Bump 2d" on page 473
- "Bump 3d" on page 475
- "Clear Coat" on page 475
- "Condition" on page 475
- "Distance Between" on page 477
- "Height Field" on page 478
- "Light Info" on page 479
- "Multiply Divide" on page 481
- "2d Placement" on page 483
- "3d Placement" on page 485
- "Plus Minus Average" on page 486
- "Projection" on page 487
- "Reverse" on page 492
- "Sampler Info" on page 493
- "Set Range" on page 494
- "Stencil" on page 494
- "Studio Clear Coat" on page 496
- "Uv Chooser" on page 497
- "Vector Product" on page 498

Array Mapper

Maps array attributes to the color attributes of texture nodes. Used by particle objects to invoke color values from the texture node for each particle.

Find this utility in the Create Bar (see "Hide, resize or customize the Create bar" on page 49).

See "Overview of particles" on page 21 in the *Dynamics* guide for more information about particle mapping.

To use this utility see, "Use the Array Mapper utility" on page 208.

Min Value, Max Value

The minimum and maximum limit on the output attribute outValuePP.

Compute Node

Allows the propagation of any changes to the computeNode's outColor through the arrayMapper and onto the attribute the arrayMapper is driving.

Bump 2d

Converts a 2D texture to bump maps. Middle-drag the 2D texture swatch over the material swatch and select bump map from the pop-up menu. Maya creates the bump2d utility.

Find this utility in the Create Bar (see "Hide, resize or customize the Create bar" on page 49).

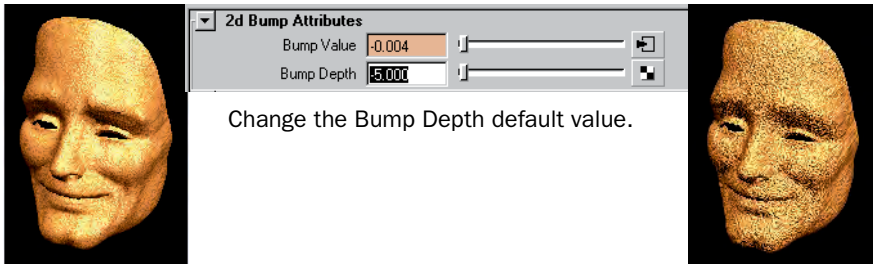
To use this utility, see "Use the Bump 2d utility" on page 208.

Bump Value

The source 2D texture used for the bump map. You can connect the output of any shading network to Bump Value to use as the source of the bumps.

Bump Depth

Controls how high the bumps display on the surface. Increase Bump Depth to make the surface bumpier. Decrease Bump Depth to make the surface smoother.



Change the Bump Depth default value.

Rendered result with bump2D default settings for a Fractal 2D texture.

Rendered result with new Bump Depth setting.

You can achieve almost identical effects by adjusting the Bump Depth or the Alpha Gain and Alpha Offset of the texture. The Bump Depth is determined by reading the alpha gain value of the texture. Both controls can be useful in complex shading networks where there may be multiple bumps. The alpha gain attribute lets you individually adjust the bump for each texture.

Bump Filter

Affects the filtering level performed on a texture used as a bump map. Maya calculates the amount of filtering based on how much screen space the texture occupies in the final image. The Bump Filter attribute is a multiplier of that value.

Values greater than 1.0 produce more filtering, making the bumps smoother. Increase the value if aliasing occurs (jagged staircase effects) in final renderings, or if the bump map appears to pop or “sizzle” over the course of several frames.

Values less than 1.0 produce less filtering, making the bumps appear sharper. Decrease the value if bumps are too smooth in the final rendered images.

Bump Filter Offset

Affects the amount of filtering performed on a texture.

Unlike the Bump Filter attribute (which is a multiplier), Maya adds Bump Filter Offset to calculated filtering values. This increases the amount of filtering uniformly.

This attribute can be used to lock Maya’s filtering values. If you want the Bump Filter Offset value to completely determine the amount of filtering, set the Bump Filter attribute to 0.

Adjust Edges

Artifacts may display on texture boundaries when you map textures with the place2dTexture’s Wrap U and Wrap V attributes turned off. Using Adjust Edges removes these artifacts when this happens, but has no effect when you turn the Wrap U and Wrap V attributes on.

Bump 3d

Converts a 3D texture to bump maps. You can also cascade bump maps on top of one another.

Find this utility in the Create Bar (see "Hide, resize or customize the Create bar" on page 49).

To use this utility, see "Use the Bump 3d utility" on page 210.

Bump Value

The source 3D texture used for the bump map. You can connect the output of any shading network to Bump Value to use as the source of the bumps.

Bump Depth

Controls how high the bumps appear on the surface. Increase Bump Depth to make the surface bumpier. Decrease Bump Depth to make the surface smoother.

Bump Filter

See "Bump Filter" on page 474.

Bump Filter Offset

See "Bump Filter Offset" on page 474.

Clear Coat

This utility is a plug-in (`clearcoat.mll`). You can use this node in situations where certain materials, such as car paint, reflect light differently depending on the relationship between the viewing direction and surface orientation.

Find this utility in the Create Bar (see "Hide, resize or customize the Create bar" on page 49).

To use this utility, see "Use the Clear Coat utility" on page 210.

The clearCoat node has the same attributes as the studioClearCoat node. For more information, see "Studio Clear Coat" on page 496.

Condition

Incorporate the Condition utility in shader networks capable of acting one way in one set of circumstances and another way in a different set of circumstances. For example, you can create a double-sided shaded surface (see "Double-sided shaded surfaces" on page 29).

Find this utility in the Create Bar (see "Hide, resize or customize the Create bar" on page 49).

To use this utility, see "Use the Condition utility" on page 211.

Condition produces a color value depending on the conditions you set. It requires one logical operator and two choice values, as shown in the following example:

```
If (A operation B)
Outcolor = Color1
else
Outcolor = Color2
```

Condition compares the value in A with the value in B to find out whether the value in A is greater, smaller, equal to, less than, less than or equal to, greater than or equal to, or not equal to the value in B.

Since it is a branching function, it does one thing if a logical expression is true and something else if it is false. For example, if the value in A is not equal to the value in B, Color If True is chosen in OutColor. If the value in A is equal to the value in B, and Color If False is chosen in OutColor.

Find this utility in the Create Bar (see ”Hide, resize or customize the Create bar” on page 49).

First Term

Represents the first term of the condition.

Second Term

Represents the second term of the condition.

Operation

Displays a drop-down list from which you can select an operator. The operators include: Equal, Not Equal, Greater Than, Greater or Equal, Less Than, Less or Equal.

Color If True

The color or texture that is output when the condition is true.

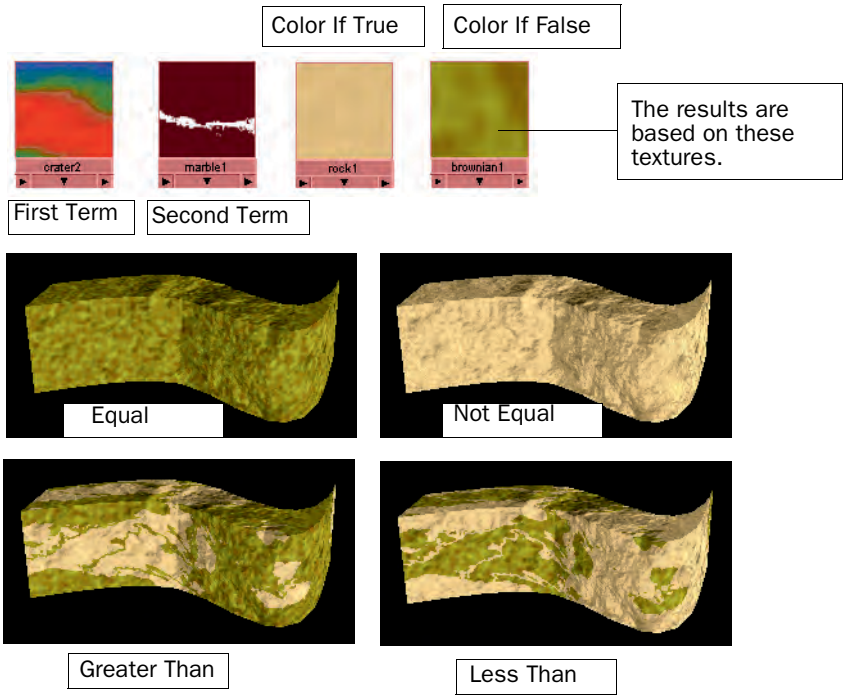
Color If False

The color or texture that is output when the condition is false.

Out Color

The output attribute with the result obtained. *Available in the Connection Editor only.*

The following shows some examples of the Condition utility in use:



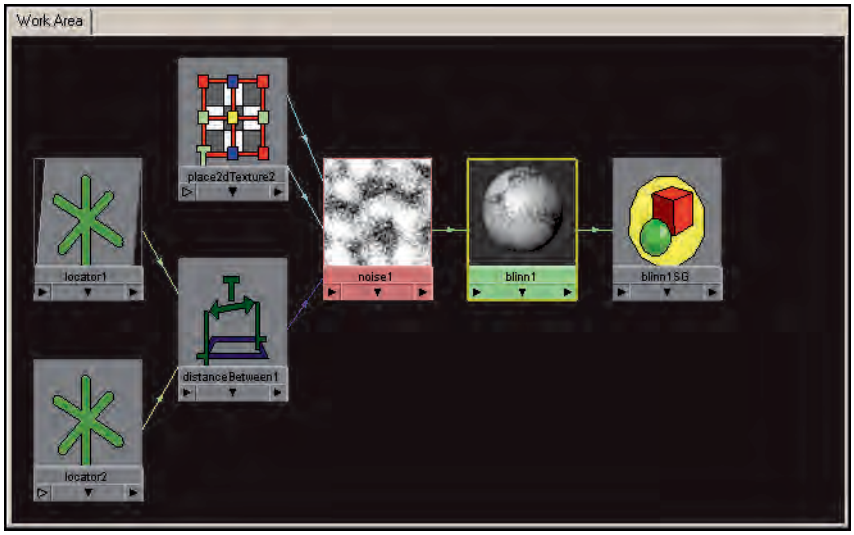
The Condition utility can be something as simple as comparing the values in the First Term and the Second Term. The result of this comparison makes it possible to change the color or texture of an object.

For example, if the First Term is less than the Second Term, the resulting color of the object (OutColor) is Color If True, and Color If False appears when the First Term is not less than the Second Term.

Tip Because you can also map all the input attributes, you can switch between two textures, for example, connecting them to Color If True and Color If False.

Distance Between

The Distance Between utility uses the distance between two locator points in the scene to control an attribute of the shading material or texture that it's connected to. For example, you can control the frequency of a noise texture with the Distance Between utility as shown:



Find this utility in the Create Bar (see "Hide, resize or customize the Create bar" on page 49).

To use this utility, see "Use the Distance Between utility" on page 211.

Point1

The X, Y, Z axis coordinates for the locator to be used as the first point of the distance between utility.

Point2

The X, Y, Z axis coordinates for the locator to be used as the second point of the distance between utility.

Height Field

This draws a plane that interactively shows the displacement of a Surface texture or an Ocean Shader. It is currently for preview or interactive display purposes only, and does not appear in a render. Use it to preview the displacement effects and then recreate them by mapping the same texture displacement to your target shader.

Find this utility in the Create Bar (see "Hide, resize or customize the Create bar" on page 49).

To use this utility, see "Use the Height Field utility" on page 212.

Resolution

The number of samples relative to the largest side of the plane. Higher values result in a more detailed surface, but slower draw time.

Color

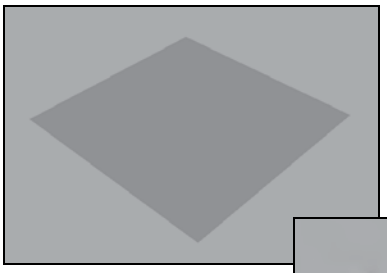
The basic color of the preview surface. This can be mapped with a Surface texture or an Ocean Shader; however, only the outColor value can be used.

Displacement

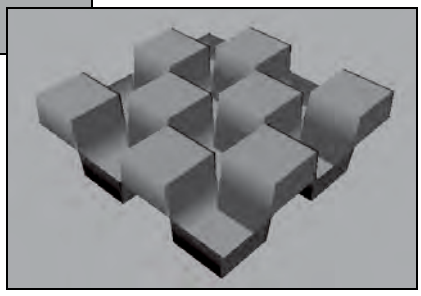
The displacement of the plane. This may be mapped with a Surface texture or an Ocean Shader; however the outAlpha value is always used. This does an optimized evaluation of the texture that ignores added shading engine inputs.

Height Scale

Scale factor for input displacement. As the value increases, the displacement is more pronounced.



The Checker texture is mapped to the Height Field's Displacement attribute. The Height Scale value is zero.



The Checker texture is mapped to the Height Field's Displacement attribute. The Height Scale value is 0.25.

Light Info

Similar to the Sampler Info node, Light info provides light information instead of surface property information. You use the Light Info utility node to obtain information about the position of a light relative to a texture. As each point on the texture is shaded, the attributes of Light Info can determine the precise distance from the light to the point being shaded.

The Light Info node provides:

- The position of the light in world space.
- The direction the light is shining (if it is not a point light).
- The distance from the light to the point being shaded.

Find this utility in the Create Bar (see "Hide, resize or customize the Create bar" on page 49).

To use this utility, see "Use the Light Info utility" on page 212.

Light Position

The position of the connected light in world space. The connected light is the light (or other object) whose World Matrix attribute is connected to the World Matrix attribute of this node.

Light Direction

The direction in which the connected light is shining. Point lights shine in all directions.

Sample Distance

The world-space distance between the connected light and the point on the surface being shaded.This can be calculated in different ways. See Light Direction Only for details.

World Matrix

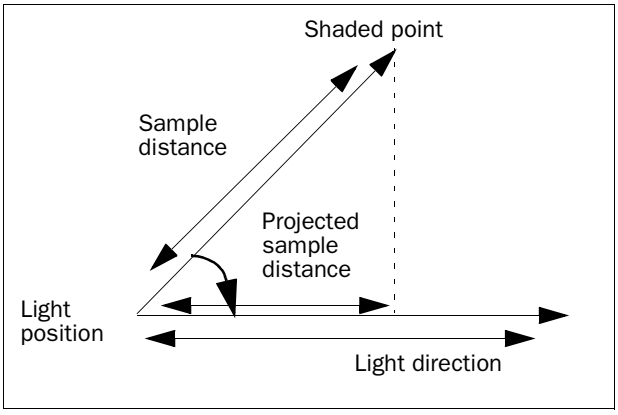
Connect the output World Matrix attribute of a light or other object to this attribute. This must be done before the output of this node is usable.

Light Direction Only

Controls how the Sample Distance attribute is calculated. If off, the Sample Distance is the world-space distance from the light to the point being sampled.

If on, the Sample Distance is the distance along the light direction vector to the closest point on that vector to the point being sampled.

In mathematical terms, it returns the length of the projection of the light-to-object vector onto the light-direction vector.



Note The Light Data attributes work with light information in camera space, whereas the Light Direction attribute of the Light Info utility works with light information in world space.

Multiply Divide

Multiplies or divides input attributes. This utility is divided into three parts—two input attributes, an operator you apply to the two input attributes, and an output attribute to hold the result of the operation. The input and output attributes represent X, Y and Z. Use this node to multiply colors or triple-value attributes.

Find this utility in the Create Bar (see "Hide, resize or customize the Create bar" on page 49).

To use this utility, see "Use the Multiply Divide utility" on page 213.

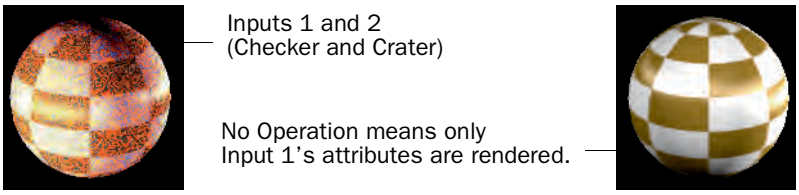
Operation

Displays a pop-up menu from which you can select an operator.

No operation

Copies the value of the Input1 attribute to the output attribute without making any changes.

For example, if Input 1 is a Checker texture and Input 2 is a Crater texture, when you select No Operation, only the Checker texture's attributes are rendered.



Multiply

Multiplies the Input1 attribute and the Input2 attribute, as in the following formula:

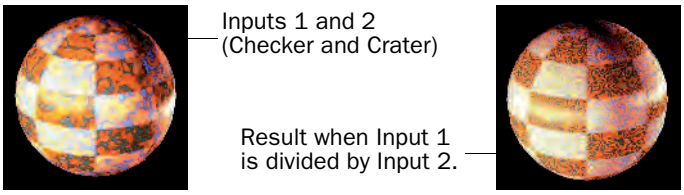
$$Output = Input1 \times Input2$$

Divide

Divides the Input1 attribute by the Input2 attribute, as in the following formula:

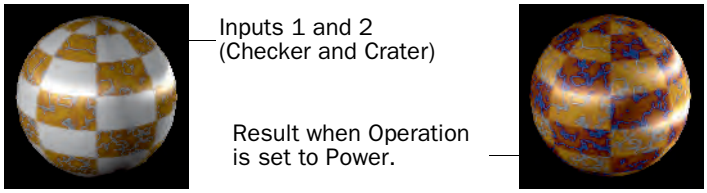
$$Output = \frac{Input1}{Input2}$$

In the following example, the Input 1 texture is divided by the changes made to the Input 2 texture.



Power

Sets the output to equal Input 1 raised to the power of Input 2. See the following example:



It evaluates an expression by raising the value to the power of a number you choose or by calculating the square root. Raising a value to the power means multiplying a number by itself a given number of times as in:

$$2^3 = 2 \times 2 \times 2$$

The command for calculating the square of a number is:

power (value, 2.0)

The mathematical formula is:

$$Power = value^2$$

The formula for computing the square root is:

$$Power = \sqrt{value}$$

If you want to multiply the value of a component twice, you would set Input1 to represent the color (possibly mapping it with a texture), and then set all the three components of Input2 to 2.0. Because the inputs are both colors, you can work on the color of a single-component value or on all three-component values.

You can also get the square root of a number by setting Input2 to 0.5 as shown in the following:

```
Output = power (input1, input2)
```

which, in math terms, would be written like input1^input2.

See also the “Power” operator example.

Input1

The first of two arguments presented to Multiply Divide.

Input2

The second of two arguments presented to Multiply Divide.

2d Placement

Defines a texture frame—a rectangular area on a surface (in the UV coordinate space) in which the texture appears. You can control the position, size, and rotation of this frame on the surface using the “Coverage”, “Translate Frame”, and “Rotate Frame” attributes. You can also control how the texture is tiled within the frame using the “Repeat UV”, “Rotate UV”, “Offset”, “Mirror U, V”, “Stagger”, and “Wrap U, Wrap V” attributes.

The two columns of boxes in the Attribute Editor represent U and V values.

Find this utility in the Create Bar (see ”Hide, resize or customize the Create bar” on page 49).

To use this utility, see ”Use the 2d Placement utility” on page 213.

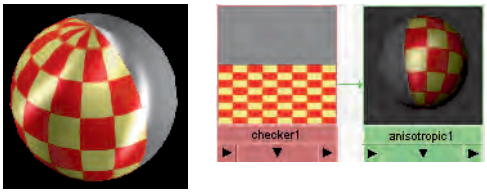
Interactive Placement

Displays the texture placement manipulator. Either click this button from the Attribute Editor, or click the Texture Placement Tool icon in the main window and select the surface. Middle-drag the manipulator handles to place the texture.

Coverage

Specifies what ratio of the surface the texture map covers. The valid range is 0 to + infinity for NURBS surfaces. A value of 1 (the default) covers the entire surface in either the U or V direction.

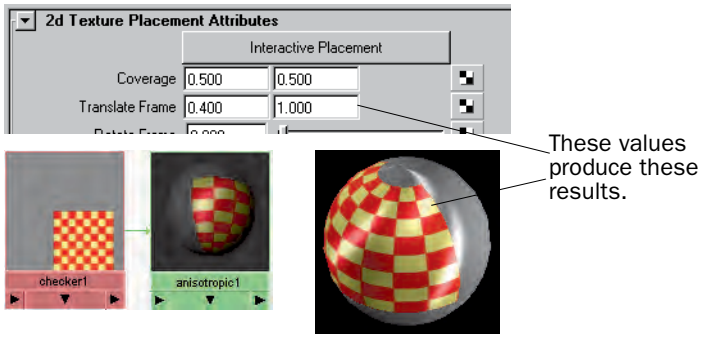
For example, to cover half the surface, set the value at 0.5 in both the U and V directions.



U = 1.0, V = 0.5

Translate Frame

The Translate attributes position the texture map on the surface and move the coverage area across the surface. The range is from - infinity to + infinity.



Rotate Frame

Rotates the texture map on the surface. This attribute is represented in degrees.

Mirror U, V

Only works when U Repeat or V Repeat attributes are greater than 1. Mirror in the U and V direction separately. When on, the repeat areas are mirrored—rows of images display as mirrored images of themselves. This helps to disguise the effect of seams between repeat areas.



Default File 2D texture placement.



After you select Mirror and place the texture.

Stagger

Maya offsets repeats of maps making alternate rows of repeats offset exactly by half (like brick walls). When off, the repeats line up horizontally and vertically.

Wrap U, Wrap V

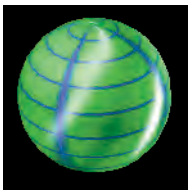
Wrap U and Wrap V attributes control whether a map is repeated in U or V directions, or both U and V. Both the Wrap attributes are on by default. Turn these off to prevent seams from showing on a closed surface, such as a cylinder or sphere, or to prevent the texture from duplicating itself when you use Translation and Coverage attributes to limit the mapping to a very specific surface area.

Repeat UV

Specifies how many copies of the texture map are mapped within the coverage area along either the U or V directions (depending on the texture). By default, Maya maps one copy of the texture. Values greater than 1 result in more copies of the map displayed in the same coverage area. Values less than 1 result in only a portion of the map displayed.



Repeat:
U = 4
V = 4



Repeat:
U = 10
V = 4

Offset

Offsets the pattern of the texture map. This can be particularly useful when fine-tuning the placement of a pattern on a surface. U Offset offsets the texture pattern along the U direction and V Offset along the V direction. Each value ranges from - infinity to + infinity.

Rotate UV

Since you cannot use the interactive tool to rotate surface placement, use this attribute. Rotate UV is calculated in degrees. The valid range is 0 to 360 degrees.

Noise UV

2D noise for U and V. Displaces the colors of the texture map.

Fast

When on, Fast checks if the placement is the default and all shading-time evaluations perform less computations. Turn Fast on to slightly improve rendering speed. Fast is off by default.

3d Placement

A 3D placement node defines a 3D texture or Environment texture's positioning and orientation in world space. 3D placement nodes make it easier to texture multiple surfaces as if they were one.

You can reposition 3D textures with numerical precision in the place3dTexture node's Attribute Editor, or you can use manipulators to reposition textures or labels interactively.

Maya provides two methods to place 3D textures on NURBS surfaces—Interactive Placement or Fit to group bbox (bounding box). Select the method most suitable for your needs. Sometimes using both methods works best.

When you create a 3D texture or project a texture onto an object (rather than apply it as a normal or as a stencil), a cube-shaped icon appears in the scene that corresponds to the size, scale, and location of the texture on the surface. Especially for animated or deforming objects, you must maintain the correct positioning of the texture on the object. (If the object is animated, you could parent the 3D icon to the geometry, for example.)

Find this utility in the Create Bar (see "Hide, resize or customize the Create bar" on page 49).

To use this utility, see "Use the 3d Placement utility" on page 214.

Plus Minus Average

Add, subtract, or average values in a list of input attributes. The Plus Minus Average utility has three parts—two or more input attributes, an operator that you apply to these input attributes, and an output attribute that holds the result of the operation.

Find this utility in the Create Bar (see "Hide, resize or customize the Create bar" on page 49).

To use this utility, see "Use the Plus Minus Average utility" on page 215.

Operation

Displays a pop-up menu from which you can select an operator

No operation

Copies the value of the Input1 attribute to the output attribute without making any changes.

Sum

Adds the values in the Input list, as in the following formula:

$$Output = Input1 + Input2 + \ldots + InputN$$

Subtract

Calculates the difference between one element in the list and another element in the list, as in the following formula:

$$Output = Input3D[1] - Input3D[2]$$

For example, if you want to subtract Input3D[1] from Input3D[2] of multi-attribute nodes, make the necessary connections using the right mouse button in the Connection Editor and then select Subtract.

Average

Adds the values in each Input attribute and divides the result by the number of input attributes, as in the following formula:

$$Output = \frac{Input1 + Input2 + \ldots + InputN}{N}$$

where N is the number of input attributes.

For example, if there are seven input values in the list, the values for each input in the list ranging from one to seven are added and the result is divided by seven.

Input1D

A list of elements composed of single-value connections. The values in the list can be added, subtracted, or averaged depending on the Operation you select.

Input2D

A list of elements composed of two-value connections. The values in the list can be added, subtracted, or averaged depending on the Operation you select.

Input3D

A list of elements composed of three-value connections, such as color. The values in the list can be added, subtracted, or averaged depending on the Operation you select.

Tip	Give nodes meaningful names to help you remember their functions. For example, rename the first Multiply Divide node to PowerSquare, the Plus Minus Average node to SumComponents, and the second Multiply Divide node to PowerSquareRoot.

Projection

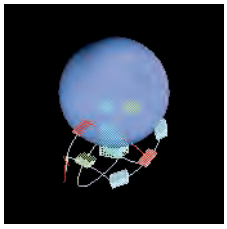
Turns any 2d texture into a 3d texture you can place on the surface using one of the available projection types. Use to adjust the texture placement on the surface.

Find this utility in the Create Bar (see "Hide, resize or customize the Create bar" on page 49).

To use this utility, see "Use the Projection utility" on page 215.

Interactive Placement

Displays the Projection manipulators in the scene view.



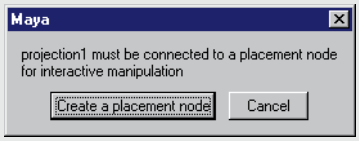
Spherical “Proj Type”

Tip Use “Fit To BBox” to center the manipulator around the object.



Using these manipulators in combination with Maya’s transform tools, you can orient and position the texture map in three dimensions. The manipulators for texture mapping are exactly the same as those used for texturing polygons. See the ”Polygon modeling overview” on page 12 in the *Polygonal Modeling* guide for details.

Note If no place3dTexture node exists, Maya displays the following alert box:



Click the Create a placement node button to create the place3dTexture node.

Fit To BBox

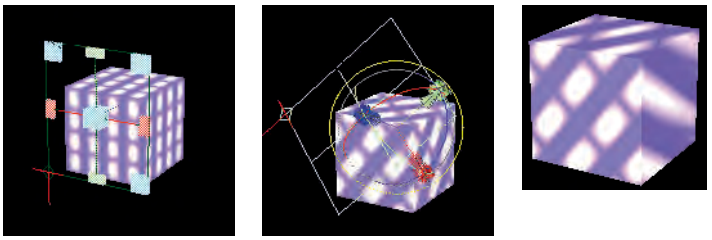
The texture map coincides with the bounding box of the mapped object or set. See also ”Interactive Placement” on page 487.

Proj Type

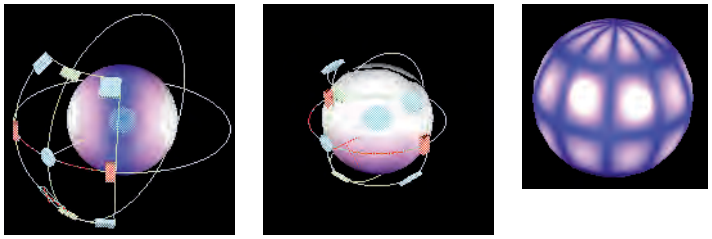
Select a projection type from the drop-down list to display seven projection manipulators.

Off Uses no projection type.

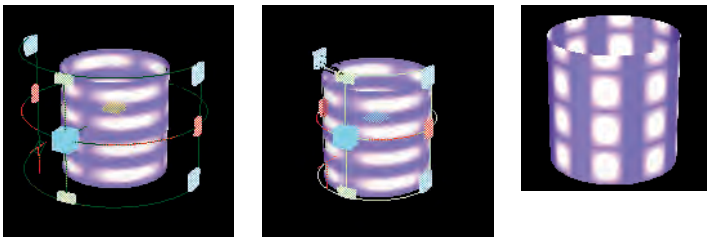
Planar Default Proj Type. Places the texture on a planar surface and projects it onto the object.



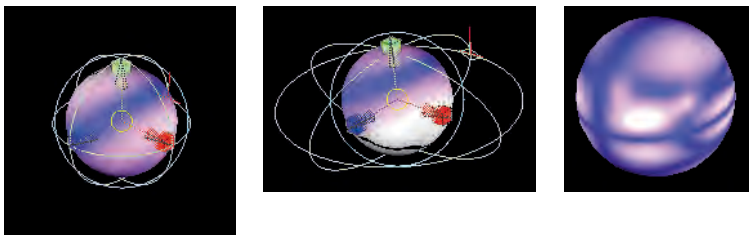
Spherical Places the texture inside a sphere and projects it onto the object.



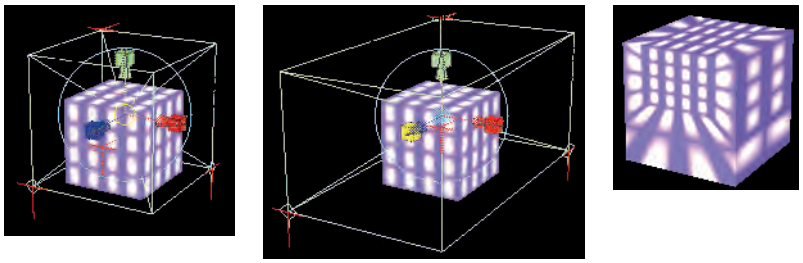
Cylindrical Places the texture inside a cylinder and projects it onto the object.



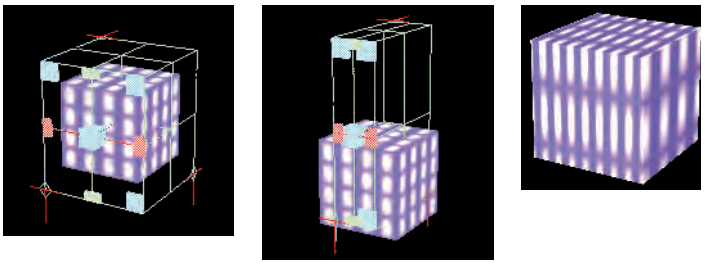
Ball Places the texture inside a ball and projects it onto the object. For example, Maya projects the texture as if a candy wrapper is pulled around a lollipop. There is one pinch point to the mapping at the -z-pole, as opposed to the two pinch points at the +y and -y poles in spherical and cylindrical mapping.



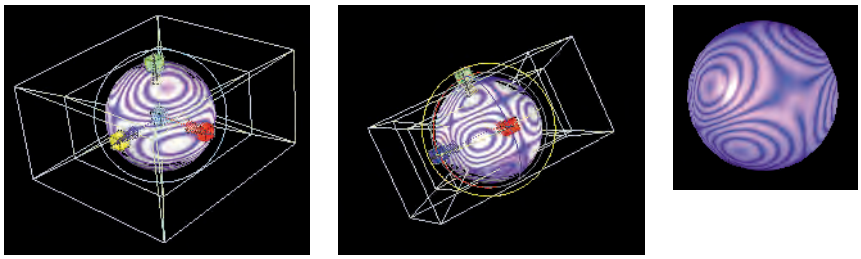
Cubic Defines the projection surface as a box. Maya places images on each plane and projects them onto the object.



Triplanar Extrudes the texture along the axis defined by the maximum direction of the surface normal. The texture is projected much like fabric pulled around an arc.



Concentric Projects a vertical slice of the texture from the inside to the outside edge of the voxel. The vertical slice used is randomly chosen for each voxel. A *voxel* is a 3D version of a rectangle—a voxel grid is a series of 3D cubes that line up to form a bigger cube.



Perspective Integrates 3D elements with a background image or a live action sequence.

Examples

You have a background sequence with a vase on a table you want to blow up. It can be difficult to produce a parametric or solid texture map that exactly matches the vase, but if you use the Perspective Proj Type, you can project the real image of the vase from the background sequence onto a 3D vase placed in a matching position. This allows a perfect match of textures from the camera's point of view.

You want to place a 3D flying saucer within an image of a street scene. The image of the street scene should accurately reflect onto the flying saucer. You could do this with an environment texture, but that would require that you have other images available—if you use the Perspective Proj Type, you can project the image of the street scene onto stand-in geometry. The image projected onto the stand-in geometry accurately reflects onto the flying saucer.

Image

The 2D texture to be used as a map.

Tip	To undo a mapping, in the Attribute Editor, right-click while the cursor is over the attribute's name and select Break Connection from the pop-up menu.

U angle

For spherical and cylindrical mapping only. Changes the U angle.

V angle

For spherical mapping only. Changes the V angle.

Camera Projection Attributes

Control a Projection node when the Proj Type is Perspective.

Link To Camera

The drop-down list contains a list of the perspective cameras in the scene. Choose the camera from which you want to project the image.

Fit Type

Controls how the texture fits to the camera when Proj Type is Perspective. Select from the following:

None The image is not squeezed or stretched to fit. One of its axes (determined by the Fit Fill setting) fits to the film gate, and the other resizes appropriately.

Match Camera Film Gate Squeezes the image to fit the film gate.

Match Camera Resolution If you use this to match a backdrop, match these settings to the settings in the Image Plane. Usually, the image plane is the same size as the rendered image. If so, use the Match Camera Resolution setting.

Fit Fill

Only available if Proj Type is Perspective and Fit Type is None. If the image plane aspect ratio is not the same as the film gate aspect ratio, this attribute decides which axis of the image is fit to the film gate.

Noise Attributes

Controls the amount of fractal noise added to a Projection node. (Adding fractal noise randomizes or blurs the texture).

Amplitude X/Amplitude Y

Scales the amount of fractal noise added to the projection in the X or Y direction. When Amplitude X and Amplitude Y are 0, no fractal noise is added.

Ratio

Controls the frequency of fractal noise. Increase this value to increase the fineness of detail.

Ripples

Determines how wavy the projected image is when projected, but controls the scale of the frequency of any fractal noise added to the texture. If increased in any direction, the fractal detail seems to smear out in that direction.

Recursion Depth

Depth

Controls the amount of calculation done by the texture when Ripples are added. Fractal noise such as ripples are created by a mathematical process; as the process goes over more levels, it produces a more detailed fractal, but takes longer. Normally, the texture chooses a level appropriate for the volume rendered. You can use Depth Min and Depth Max to control the minimum and maximum amount of calculation.

Reverse

Reverses node effects. For instance, you can reverse a transparency map if the white and black areas are the inverse of what they should be.

Find this utility in the Create Bar (see "Hide, resize or customize the Create bar" on page 49).

To use this utility, see "Use the Reverse utility" on page 215.

Reverse Attribute

Input

Represents the reversed values.

Sampler Info

Provides you with information about each point on a surface as it is being sampled, or calculated, for rendering purposes. Sampler Info can give you information about a point's position in space, its orientation and tangency, and its location relative to the camera.

Many of the attributes for this node provide values in *camera coordinate space*, the local object space of the camera. Each camera (in its own space) is located at the point 0, 0, 0. It looks straight along the negative Z axis, and the positive Y axis points up.

Find this utility in the Create Bar (see "Hide, resize or customize the Create bar" on page 49).

To use this utility, see "Use the Sampler Info utility" on page 216.

Point World

Provides the position currently being sampled relative to the X-,Y-, and Z-axis of the world.

Point Obj

Provides the position currently being sampled relative to the X-,Y-, and Z-axis of the object.

Point Camera

Provides the point of the object being shaded. This point is located in XYZ camera space. You can connect this surface point in materials for the object being shaded to show some interesting effects based on the camera view.

Normal Camera

Provides the orientation of a face relative to the camera.

Uv Coord

Provides the UV coordinates of a point to be shaded. The convention is that UV coordinates are measured from 0 0 to 1 1.

Ray Direction

Indicates the direction in which the current point is seen from the camera. Use this attribute in materials for objects to provide the direction towards the camera for every pixel in the object.

Tangent UCamera, Tangent VCamera

Sets the surface tangents in camera space (as opposed to world space or object space). For polygons, the tangents are generally not defined. NURBS have a well-defined tangent space (as visible in Maya; create a NURBS object, display its CVs and notice the NURBS object has a U direction and a V direction).

Mathematically, tangents provide an instantaneous direction perpendicular to their point of origin on a surface. Their magnitude is affected by the rate of change (curvature) of the surface. A good math book should have a diagram showing the tangent to a curve, which can then be extrapolated to give you an idea of what tangents on a surface look like. *Tangent U and Tangent V Camera attributes are for advanced users only*.

Pixel Center

Provides Pixel Center X and Pixel Center Y. The result depends on the image, not on the geometry.

Facing Ratio

Produces a value that varies between 0 and 1 depending on the angle between the surface normal and view direction.

Flipped Normal

Turn on or off depending on whether the object is textured differently on either side. The flipped normal attribute indicates if the surface normal is flipped which also tells you which side of the surface Maya is shading.

Set Range

Sets the range within which you want an effect to take place when you don't want to operate on an entire scene. The Set Range utility is used in combination with other nodes.

Find this utility in the Create Bar (see "Hide, resize or customize the Create bar" on page 49).

To use this utility, see "Use the Set Range utility" on page 218.

Value

Maya maps this value from the old range (Old Min to Old Max) into the new range (Min to Max).

Min/Max

The minimum and maximum value in the new range.

Old Min, Old Max

The minimum and maximum value in old range.

Stencil

Maps any image input onto an object (such as a shading network, or a file texture). You can mask the input image to control how it covers a surface, to overlay different textures and control what parts of the texture are visible, or to label map a surface.

Find this utility in the Create Bar (see "Hide, resize or customize the Create bar" on page 49).

To use this utility, see "Use the Stencil utility" on page 219.

Image

The texture that is used as a stencil.

Edge Blend

Controls the sharpness of the texture edges. The default Stencil's color is the color of the edge blend. Increase this value to blend edges softly.

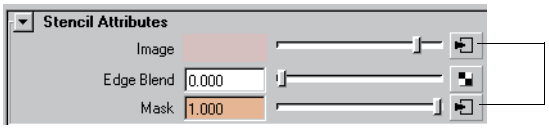
Mask

Represents the Stencil's transparency. Use to control the overall transparency of the entire texture. To control the transparency of selected regions of the texture, map another texture to Mask.

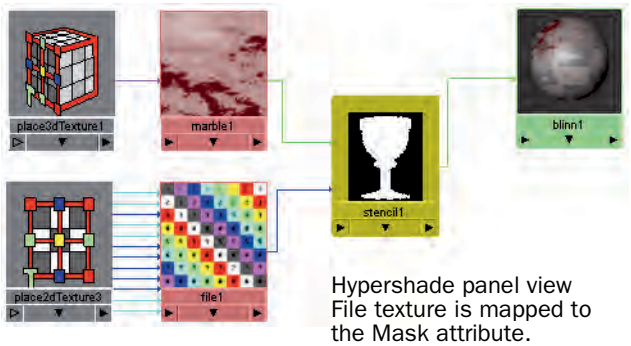
For example, this is what happens when you map a File texture to the Mask attribute.



Marble texture as Stencil Image.



Map a File texture to the Mask attribute.



Hypershade panel view
File texture is mapped to the Mask attribute.



Rendered result.

HSV Color Key

Key Masking

Enables or disables Chroma Key masking. When on, Maya selects the areas in the texture similar to or equal to the Color Key color and masks them out. When off, all other key attributes have no effect.

Positive Key

Inverts the chroma key mask (only the colors specified in the Color Key and HSV Range are displayed). The default setting is off (the colors specified in the Color Key and HSV Range are masked).

Color Key

The color to be masked in the texture. The default setting is black. To mask a range of colors, you must also set the Hue/Sat/Val Range parameters.

Hue Range

The range of hues (H) centered on the Color Key color which are also masked. The valid range is 0 to 1. The default value is 0.5.

Saturation Range

The range of saturations (S) centered on the Color Key color which are also masked. The valid range is 0 to 1. The default value is 0.5.

Value Range

The range of values (V) centered on the Color Key color which are also masked. The valid range is 0 to 1. The default value is 0.5. If you want to mask out the exact key color, set V to 0.

Threshold

Controls the point at which the color state changes.

Studio Clear Coat

This utility is a plug-in (`studioImport.mll`). You can use this node in situations where certain materials, such as car paint, reflect light differently depending on the relationship between the viewing direction and surface orientation.

Find this utility in the Create Bar (see "Hide, resize or customize the Create bar" on page 49).

To use this utility, see "Use the Studio Clear Coat utility" on page 220.

studioClearCoat is a separate node. In Maya, complex shading networks can be built with many smaller nodes, but because studioClearCoat is its own node, it can be applied to any material (even plug-in materials). You plug the output of the studioClearCoat node into the Reflectivity of the material.

You can use IPR to tune studioClearCoat attributes. This is especially powerful when you apply the output of the studioClearCoat node into the color of a Surface Shader node.

In the following, white shows maximum reflectivity and black shows minimum reflectivity.



When satisfied with the studioClearCoat settings, you can plug the output back into the material's Reflectivity attribute and be confident of the result.

The next image was produced using the studioClearCoat plug-in. Notice how the hood and top of the car are more reflective than the front and sides of the car.



Image by
Dua Xiong

As well as the generic Caching and Node State operations, studioClearCoat contains the following attributes:

Index

Describes the refraction properties of the material.

Scale

A simple multiplier on the final result.

Bias

Controls the middle point of the contrast adjustment and is added to the final result. Increase Bias to move the middle point upwards (more of the texture becomes dark as contrast increases). Decrease Bias to move the middle point down (more of the texture becomes light as contrast increases).

The computation is:

final result= f(index of refraction) * scale + bias

Where f(index of refraction) is the studioClearCoat computation with the index of refraction as input.

Uv Chooser

This node is automatically created by Maya when connecting UV sets to file texture nodes. It controls which available UV sets on an object control the surface placement of shader channels mapped to file texture nodes.

Because this node is automatically created by Maya, you should not manually create it and adjust the connections.

Vector Product

Multiplies a vector by another vector or by a matrix. The Vector Product node has three parts—two input attributes, an operator that you apply to the two input attributes, and an output attribute that holds the result.

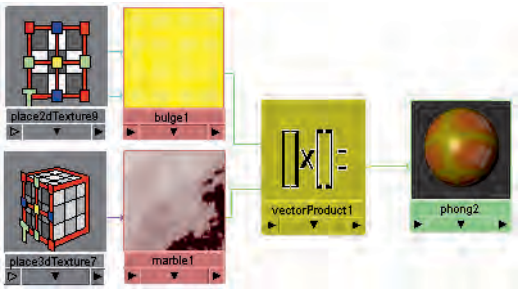
- A *vector* is the quantity of an attribute (such as color) which has direction (X, Y, and Z) as well as magnitude.
- A *matrix* is an array of interconnected attributes. These attributes are combined to create one single entity.

Find this utility in the Create Bar (see ”Hide, resize or customize the Create bar” on page 49).

To use this utility, see ”Use the Vector Product utility” on page 220.

Operation

Displays a pop-up menu from which you can select an operator. The following examples are based on Input 1 as a Bulge texture and Input 2 as a Marble texture.



No operation

Copies the value of the Input1 attribute to the output without making any changes.

Dot Product

A single-component value produced by the dot product of the two input vectors. The value of the dot product is copied to the three components of the vector produced.

Cross Product

The result of two input vectors.

Vector Matrix Product

Produces a vector by multiplying the Input1 attribute and the Matrix attribute, as in the following formula:

Outvector = Input x Matrix

Point Matrix Product

Produces a point by multiplying the Input1 attribute and the Matrix attribute as in the following formula:

Output = Input x Matrix

Color Utilities

About Color Utilities

Maya provides color utilities in the Create Render Node that allow you to blend colors, increase or decrease contrast, or remap scalar or color values, etc. A list of available color utilities is as follows:

- "Blend Colors" on page 499
- "Clamp" on page 500
- "Contrast" on page 500
- "Gamma Correct" on page 501
- "Hsv to Rgb" on page 501
- "Luminance" on page 502
- "Remap Value" on page 502
- "Remap Color" on page 503
- "Remap HSV" on page 504
- "Rgb to Hsv" on page 505
- "Surf. Luminance" on page 505

Blend Colors

To use this utility, see "Use the Blend Colors utility" on page 221.

Blends two input values using a mixer. You use a mask to determine where to put two materials placed on an object.

Find this utility in the Create Bar (see "Hide, resize or customize the Create bar" on page 49).

Blender

Controls how much of each of the input colors mixes into the final Output. As the value increases, you see more of Color 1 and less of Color 2. As it decreases, you see more of Color 2 and less of Color 1.

Color1/Color2

Color1 and Color2 are the first and second input colors (or textures). Click to access the mapped node's attributes.

Clamp

Isolates colors within a relatively complex texture.This is helpful when you create complex shader networks.

Find this utility in the Create Bar (see "Hide, resize or customize the Create bar" on page 49).

To use this utility, see "Use the Clamp colors utility" on page 223.

Min

The minimum values for the color channels.

Max

The maximum values for the color channels.

Input

The input color or texture that Maya clamps.

Contrast

Use to increase or decrease the contrast in a texture. You can control the contrast of each of the R, G, and B channels individually.

When you increase Contrast, light colors become lighter and dark colors darker. When you decrease contrast, you bring all the colors closer to the middle range. The Bias attribute controls the center of this range.

Find this utility in the Create Bar (see "Hide, resize or customize the Create bar" on page 49).

To use this utility, see "Use the Contrast utility" on page 224.

Value

The input color or texture to adjust.

Contrast

Controls the amount of contrast adjustment. You can adjust the contrast of the R, G, and B components individually. Increase Contrast to make light colors lighter, and dark colors darker. Decrease Contrast to make everything gray.

Bias

Controls the middle point of the contrast adjustment. Increase Bias to move the middle point upwards (more of the texture becomes dark as contrast increases). Decrease Bias to move the middle point down (more of the texture becomes light as contrast increases).

Gamma Correct

Converts an HSV (Hue-Saturation-Value) color into an RGB (Red-Green-Blue) color. This is useful when you want to control a color using HSV values. For example, you can animate a material to run through all the rainbow colors. (This is the same as animating the Hue of an HSV color).

To animate a material, create an HSV to RGB node, connect the Out Rgb attribute to the material's color, then animate the first channel of InHsv.

Use Gamma Correction to smoothly remap the colors in an image. Extreme values (very light or very dark) do not change much, but you can make mid-range tones brighter or darker.

This utility lets you specify different gamma values for the three channels of the input. The typical formula for calculating gamma is:

```
new == old ** (1.0/Gamma)
```

Find this utility in the Create Bar (see "Hide, resize or customize the Create bar" on page 49).

To use this utility, see "Use the Gamma Correct utility" on page 224.

Value

The input color or texture to gamma-correct.

Gamma

Controls the amount of gamma correction applied to each channel. A value of 1 means that the color is not adjusted. Increase Gamma to make the mid-range tones brighter. Decrease Gamma to make them darker.

In Hsv

The input color (represented as Hue, Saturation, and Value) converted to an RGB color.

Out Rgb

The output RGB color calculated.

Hsv to Rgb

Converts an HSV (Hue-Saturation-Value) color into an RGB (Red-Green-Blue) color.

Some effects are easier to calculate using HSV values instead of RGB values. You can convert the output of any shading network into HSV values.

Find this utility in the Create Bar (see ”Hide, resize or customize the Create bar” on page 49).

To use this utility, see ”Use the Hsv to Rgb utility” on page 225.

In Hsv

The color converted into HSV values.

Out Rgb

The output Rgb values.

Luminance

Converts color to grayscale. The luminance derives from a color value. Maya uses the following formula to calculate the luminance by adding the following amounts of red, green, and blue.

```
Luminance = 0.3 red + 0.59 green + 0.11 blue
```

Find this utility in the Create Bar (see ”Hide, resize or customize the Create bar” on page 49).

To use this utility, see ”Use the Luminance utility” on page 225.

Value

The input color or texture.

Remap Value

Remaps a scalar input to both scalar and color outputs. The scalar output is remapped with a scalar gradient, and the color output is remapped using a color gradient.

You can remap color and alpha values and control each of them separately. So, for example, you can define mappings where the alpha is the inverse of the color, or where they have different ranges.

Find this utility in the Create Bar (see ”Hide, resize or customize the Create bar” on page 49).

To use this utility, see ”Use the Remap Color, Remap Hsv, or Remap Value utilities” on page 226.

Usage

How you use Remap Value depends on what you want to remap.

For example you can vary reflectivity based on the facingRatio in either of the following ways:

- Connect a samplerInfo facingRatio to the inputValue, and connect the outValue to your shader's reflectivity.
- Connect the outColor the shader specularColor.

Initially the part of the surface facing the view will be more reflective, but you can reverse this by reversing the gradient (make the value gradient go down to the right, or if you mapped the outColor make the color gradient become darker to the right).

Input and Output ranges

The input attributes index into the gradient controls, which define a new output value. Usually, you connect a varying attribute of some sort (such as values from the sampler info node, texture/shader outColors, or object position) to the input connection.

inputMin, inputMax

Define the values that remap into the left and the right of the gradient controls.

For example, if your input attribute varied between -1 and 1 you can set the inputMin to -1 and the inputMax to 1. This way your minimum values result in the values defined at the left of the ramp and the maximum map to the right. Values outside the min/max range will be clipped to the value at the edges of the gradient.

outputMin, outputMax

Determine the range of the output attribute. These attributes represent the top (max) and bottom (min) values of the gradients, or (in the case of a color gradient control) the displayed white (max) and black (min) output.

In some cases, you may want the outputMin/Max to match the inputMin/Max. For example if you are remapping the cameraNormalY to object color using a remapValue node, because the camera normal varies between -1 and 1, the inputMin/Max would be set to these values. However we do not want black to be -1,-1,-1, so it would make sense for the outputMin/Max to be 0 to 1.

Remap Color

Lets you remap a three-channel input (such as RGB color) to another three-channel output with three gradient controls for more precise shading.

You can also use this utility for non-shading purposes, however. For example, you could connect the translate of one object to remapColor.color, then connect remapColor.outColor to the translate of a second object, which effectively maps the position of one object onto the other. In this particular case, the second object initially follows the first then stops outside a zero to 1 bounding box. (To increase the size of this bounding range, increase both the input and output Min/Max settings.) If you reverse the gradients, the second object moves in the opposite direction. And if the graphs are wiggly, the motion of the second object would also be wiggly.

For descriptions of the utility's input and output ranges, see "Input and Output ranges" on page 503.

Find this utility in the Create Bar (see ”Hide, resize or customize the Create bar” on page 49).

To use this utility, see ”Use the Remap Color, Remap Hsv, or Remap Value utilities” on page 226.

Remap HSV

Lets you adjust the color output of nodes. It converts an RGB input to HSV, remaps using separate HSV gradients, then converts the result to a color output.

With this utility, you can fine-tune or completely change the hue, saturation, and luminance of a color with the provided gradients. For example, you could connect the outColor of a file texture to the color (input) attribute on remapHsv, then connect the remapHsv outColor to your shader color. By editing the gradients you could then modify the brightness range or hue of the file texture with a great deal of control:

- You can make the image black and white make the saturation graph all zero.
- You can invert the brightness for an x-ray effect make the value graph 1 at the left and zero at the right.

You can also remap the color of a shader by connecting the outColor of the shader into remapHsv.color then connecting remapHsv.outColor the outColor of a surface shader node. The surface shader then becomes a color correctable version of the original shader.

Note	The surface shader performs no calculations directly, it is simply a placeholder for a shading outColor attribute.

For descriptions of the utility’s input and output ranges, see ”Input and Output ranges” on page 503.

Find this utility in the Create Bar (see ”Hide, resize or customize the Create bar” on page 49).

To use this utility, see ”Use the Remap Color, Remap Hsv, or Remap Value utilities” on page 226.

Smear

Converts an RGB color into a UV coordinate offset.

This utility can be used to add a smear effect to UV coordinates using a texture to define how the coordinates are remapped. The In Rgb color is converted to an HSV color on the color wheel. Based on the HSV color position, polar coordinates are determined (angle on the wheel and distance from the center of the wheel). These polar coordinates are converted to rectangular coordinates and output as the UV offset.

In Rgb

The RGB color value that determines how far and in what direction to offset the UVs.

Find this utility in the Create Bar (see "Hide, resize or customize the Create bar" on page 49).

To use this utility, see "Use the Smear utility" on page 227.

Rgb to Hsv

Converts an RGB (Red-Green-Blue) color into an HSV (Hue-Saturation-Value) color.

Some effects are easier to calculate using HSV values instead of RGB values. You can convert the output of any shading network into HSV values.

Find this utility in the Create Bar (see "Hide, resize or customize the Create bar" on page 49).

To use this utility, see "Use the Rgb to Hsv utility" on page 226.

In Rgb

The color converted into HSV values.

Out Hsv

The output HSV values.

Surf. Luminance

Returns the part of a lit surface and the degree of light it receives from lights in the scene.

Where the object is lit by light sources, the textures appear.

Where the object is not lit, such as polygons facing away from the light sources or in the shadow, the textures do not appear.

Find this utility in the Create Bar (see "Hide, resize or customize the Create bar" on page 49).

To use this utility, see "Use the Surf. Luminance utility" on page 227.

Switch Utilities

About Switch Utilities

The following switches are available for use in Maya:

- "Single Switch" on page 506
- "Double Switch" on page 507

- ”Triple Switch” on page 508
- ”Quad Switch” on page 509

Single Switch

You use the three buttons in the Triple Shading Switch Attribute Editor to add, remove, and map textures to objects.

The inShape column contains the objects to which you want to map the utility.

The inSingle column contains the texture, file, or placement node you want to map to the object.

Find this utility in the Create Bar (see ”Hide, resize or customize the Create bar” on page 49).

To use this utility, see ”Use the Single Switch utility” on page 227.

Add Surfaces

Click to determine to which shading groups the Single Shading Switch utility is connected and connect all the surfaces in those shading groups to the Single Shading Switch utility.

inShape

Contains the name of the shape (the object) you want to connect to the Single Shading Switch utility. You can add as many objects as you want to this column.

When one of the objects in this column is rendered, Maya sets Output to its corresponding value. When none of the objects are rendered, Maya sets Output to equal the Default setting.

inSingle

Contains the texture, file, or placement node that you want to map to the object. See also “Map Item”.

Remove Item

Removes the currently selected row in the Switch table.

Map Item

Highlight the InShape column then click the Map Item button to select a texture, file, or placement node to map it to the object.

Tip	You can also place the cursor over the column, then right-click Map from the pop-up menu.

Default

For Single switches, the Default attribute represents the value of a single float (such as the Bump Depth for a material's bump mapping attribute). When a surface is shaded, if it is not in the inShape column, this value is used. Shading nodes can also be mapped to the Default.

Double Switch

You use the three buttons in the Double Shading Switch Attribute Editor to add, remove, and map textures to objects.

The inShape column contains the objects you want to map the utility to.

The inDouble column contains the texture, file, or placement node you want to map to the object.

Find this utility in the Create Bar (see "Hide, resize or customize the Create bar" on page 49).

To use this utility, see "Use the Double Switch utility" on page 230.

Add Surfaces

Click to determine to which shading groups the Double Shading Switch utility is connected and connect all the surfaces in those shading groups to the Double Shading Switch utility.

inShape

Contains the name of the shape (the object) you want to connect to the Double Shading Switch utility. You can add as many objects as you want to this column.

When one of the objects in this column is rendered, Maya sets Output to its corresponding value. When none of the objects are rendered, Maya sets Output to equal the "Default" setting.

inDouble

Contains the texture, file, or placement node you want to map to the object. See also "Map Item".

Remove Item

Removes the currently selected row in the Switch table.

Map Item

Highlight the InShape column then click the Map Item button to select a texture, file, or placement node to map to the object.

Tip	You can right-click the column, then select Map from the pop-up menu.

Default

For Double switches, the Default values represents two float values (such as the Translate Frame or Repeat UV values of a place2dTexture utility).

Triple Switch

You use the three buttons in the Triple Shading Switch Attribute Editor to add, remove, and map textures to objects. The inShape column contains the objects you want to map the utility to. The inTriple column contains the texture, file, or placement node you want to map to the object.

Find this utility in the Create Bar (see "Hide, resize or customize the Create bar" on page 49).

To use this utility, see "Use the Triple Switch utility" on page 232.

Add Surfaces

Click to determine to which shading groups the Triple Shading Switch utility is connected and connect all the surfaces in those shading groups to the Triple Shading Switch utility.

inShape

Contains the name of the shape (the object) you want to connect to the Triple Shading Switch utility. You can add as many objects as you want to this column.

When one of the objects in this column is rendered, Maya sets Output to its corresponding value. When none of the objects are rendered, Maya sets Output to equal the Default setting.

inTriple

Contains the texture, file, or placement node that you want to map to the object. See also “Map Item”.

Remove Item

Removes the currently selected row in the Switch table.

Map Item

Highlight the InShape column then click the Map Item button to select a texture, file, or placement node to map it to the object.

Default

For Triple switches, the Default attribute represents the RGB channels of a color.

Quad Switch

You use the four buttons in the Quad Switch Attribute Editor to add, remove, and map textures to objects. The inShape column contains the objects you want to map the utility to. The inQuad column contains the texture, file, or placement node you want to map to the object.

Find this utility in the Create Bar (see ”Hide, resize or customize the Create bar” on page 49).

To use this utility, see ”Use the Quad Switch utility” on page 235.

Add Surfaces

Click to determine to which shading groups the Quad Shading Switch utility is connected and connect all the surfaces in those shading groups to the Quad Shading Switch utility.

Remove Item

Removes the currently selected row in the Switch table.

Map Item

Select the InShape column, then click Map Item to select a texture, file, or placement node to map to the object.

inShape

Contains the name of the shape (the object) you want to connect to the Quad Shading Switch utility. You can add as many objects as you want to this column.

When one of the objects in this column is rendered, Maya sets Output to its corresponding value. When none of the objects are rendered, Maya sets Output to equal the Default setting.

inQuad

Contains the texture, file, or placement node that you want to map to the object. See also “Map Item”.

Default

For Quad switches, the Default attribute represents the RGB channels of a color.

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